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THE 78TH ANNUAL MEETING OF THE ASSOCIATION OF SOUTHEASTERN BIOLOGISTS

ALABAMA STATE UNIVERSITY, MONTGOMERY, ALABAMA
TROY UNIVERSITY, TROY, ALABAMA

MARCH 29 - APRIL 1, 2017

MEETING SITE: RENAISSANCE MONTGOMERY HOTEL AND SPA AT THE CONVENTION CENTER, MONTGOMERY, ALABAMA

McCall Hall, Science Building at Troy University, Troy, Alabama.

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SOUTHEASTERN BIOLOGY

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PURPOSE

The purpose of this association shall be to promote the advancement of biology as a science by encouraging research, the imparting of knowledge, the application of knowledge to the solution of biological problems, and the preservation of biological resources. The ASB has representation in Section G Committee of the AAAS. Varying types of membership are available to individuals and institutions. See inside back cover.

TIME AND PLACE OF FUTURE MEETINGS

2018 March 28-31: Featured Institutions – Baruch Marine Field Laboratory, Georgetown, SC; Coastal Carolina University, Conway, SC; Francis Marion University, Florence, SC; University of North Carolina, Pembroke, NC; and University of North Carolina, Wilmington, NC. Meeting site is the Sheraton Myrtle Beach Convention Center Hotel, Myrtle Beach, SC.

SPECIAL HONOR TO A UNIVERSITY PROFESSOR

TUSKEGEE UNIVERSITY

August 22, 2017

Dr. Lafayette Frederick
2507 Brothers Drive
Tuskegee Alabama 36083

Dear Dr. Frederick:

This letter serves to express the appreciation of your alma mater, Tuskegee University, for your outstanding career as a scientist and educator. We are especially pleased that during 2011 to 2016 you shared your life-long science and mentoring skills with Tuskegee University students and faculty. We noted with pride during this period that you received national accolades including selection as Fellow of the Mycological Society of America in 2014 at Michigan State University, and Plenary Speaker for April 2017 meeting of the Association of Southeastern Biologists in Montgomery, Alabama.

Your life's work has exemplified the pioneering pathway of one of your heroes George Washington Carver. Having entered TU at age 16 and graduated in 1943 in Technical Agriculture-Horticulture makes you one of Tuskegee University's most senior living alumni and the only one whose accomplishments and calling allowed for your continuous contributions to botany and biology for over 70 years.

During your time as a faculty member at Tuskegee University, students and faculty benefitted from your previous experience as a scientist, teacher and administrator at Southern University, Atlanta University, and Howard University, where you retired as professor emeritus. Of special note was your continued research in mycology and teaching of advanced Botany courses to upper class and graduate students.

Included among your accomplishments are numerous publications, an honorary doctorate of science degree and Distinguished Alumni Award from the University of Rhode Island, the Botanical Society of America Merit Award, the NSF Education and Human Resources Directorate Lifetime Achievement Award, the American Association Advancement of Science Lifetime Mentor Award, and Tuskegee Institute Distinguished Alumni Merit Award.

Appropriately, a species of Hawaiian shrub, Cyrtandra Frederick, was named in your honor by Harold St. John, former chairman of the University of Hawaii department of botany.

We also want to extend our appreciation to your spouse of over 60 years, Ann Frederick, who was not only a partner to you but made laudable contributions in her own right that positively impacted the Tuskegee University family-students, alumni, faculty, staff, and friends.

We collectively salute you and pray God's continued Blessings on you and your family.

Charlotte Morris
President

Channah Prakash
Dean CAS

Roberta Troy
Head, Department Biology

Walter Hill
Dean CAENS

Conrad Bonsi
Associate Dean CAENS

Burt Rowe
President TNAA

EVENTS OF THE 2017 ANNUAL MEETING IN MONTGOMERY, ALABAMA

Hosted by

ALABAMA STATE UNIVERSITY, MONTGOMERY, ALABAMA AND TROY UNIVERSITY, TROY, ALABAMA

PRESTIGIOUS AWARD PRESENTATIONS

ASB JOHN HERR LIFETIME ACHIEVEMENT AWARD

UNIVERSITY PROFESSOR HONORED

PRESENTED TO DR. JAMES D. CAPONETTI THE UNIVERSITY OF TENNESSEE, KNOXVILLE, TENNESSEE

The 2017 Association of Southeastern Biologists John Herr Lifetime Achievement Award was presented to Dr. James D. Caponetti, The University of Tennessee, Knoxville, Tennessee, at the 78th annual meeting of the Association in Montgomery, Alabama, by the award committee chair, Dr. Thomas R. Wentworth. This prestigious award is sponsored by ASB. In presenting the award, Dr. Wentworth presented the following biography of Dr. Caponetti.

Hello, my name is Tom Wentworth, this year's chair of the John Herr Lifetime Achievement Award Committee. Before I announce this year's winner, I thank the other members of the award committee, Drs. Pat Cox and Joe Winstead, for their able assistance this year.

This prestigious award was established by the Association of Southeastern Biologists in 2007 to recognize unusually significant contributions by its members to the life of the Association and to biology in the Southeastern US. The award was first presented to its namesake, Distinguished Professor Emeritus John Herr (Department of Biological Sciences, University of South Carolina), by President Kim Marie Tolson in Columbia, South Carolina, on April 20, 2007, on the occasion of the 68th annual meeting of the Association. This award is to be presented at an annual meeting of the Association to no more than one recipient, but there is no requirement that it be given every year. Recent winners include, in 2014, Raymond O. Flagg, Carolina Biological Supply Company, and in 2016, Lafayette Frederick, Tuskeegee University.

About this year's recipient – from his letter of nomination:

He joined the Botany Department at the University of Tennessee, Knoxville, in 1961 as an Assistant Professor. He remained at UT throughout his entire faculty career, and after retirement from the faculty, has continued to work within the Division of Biology at UTK coordinating undergraduate student advising and helping students choose a major and an advisor. He has received advising awards from both the College of Arts and Sciences at UTK (1995) and also from the Division of Biology at UTK (2009). During his time as a faculty member, he taught a wide range of courses from undergraduate courses in botany and biology for majors, biology for non-majors, to upper-division courses in plant morphology, plant tissue culture, and economic botany. Additionally, he taught a range of graduate courses, again focusing on plant morphology, plant tissue culture, and related methods courses. He served as a mentor for eight M.S. students, and four Ph.D. students during his career. He also served the department in a number of key roles including chairing several important committees (e.g., Graduate Committee, Curriculum Committee) as well as serving as Associate Department Head/Executive Assistant to the Department Head for 14 years.

He has been deeply involved in service to organizations promoting science and research including the Tennessee Academy of Sciences, which he attended from 1963-2000, served as Secretary from 1966-1977, and then as President-Elect and President in 1978-79. Likewise, he served as Treasurer of the American Fern Society from 1976-present, and Secretary-Treasurer of the Pteridological Section of the Botanical Society of America from 1977-1983. He has also found time to help out the local community, and has a longstanding role as a volunteer pharmacist for the non-profit Interfaith Health Clinic, for which he has maintained his pharmacy license.

His involvement in the Association of Southeastern Biologists goes back a LONG way. His CV indicates that he started attending ASB meetings and presenting research talks in1963. His service to ASB began in 1972 when he first served on the Nominating Committee. In 1982 he was appointed to the Faculty Awards Committee, and chaired the committee in 1983-1984. Perhaps his most visible role in ASB started in 2000 when he took on the role of Print Editor of *Southeastern Biology*, the official publication of ASB. *Southeastern Biology* was the primary vehicle for distributing information about ASB—calls for abstracts, information on the annual meeting, issues of governance, highlights of research and faculty from around the Southeast were featured in *Southeastern Biology*. For him, this was clearly a labor of love. When an item that might be of interest to the ASB membership came up during a meeting or even in casual conversation, he was sure to ask for a news item to include in *Southeastern Biology* He also brought the Association to life in pictures that he included liberally throughout the journal. Because of his role as Print Editor, he was an ex officio member of the ASB Executive Committee. This entails being part of many long emails and phone conversations throughout the year, attending an annual Executive Committee meeting each fall, and contributing to the collective institutional memory of the Association. Having been a part of ASB since 1963, his contributions are always founded in a deep historical perspective of ASB, and are delivered with deliberation.

Finally, another of his roles in ASB is neither elected nor appointed but is probably equally important. During the annual meeting of ASB, you can nearly always find him sitting at the ASB booth, greeting members both old and new, soliciting new members, giving out directions or congratulations, selling T-shirts, and promoting ASB in any way he can. For many, he may be one of the most consistent faces associated with ASB. Despite the fact that he has been retired from the University of Tennessee faculty for nearly 17 years, he continues to give of his time and talent to ASB. For these many contributions, we think that Jim Caponetti is highly deserving of the John Herr Lifetime Achievement Award.

The John Herr Lifetime Achievement Award Committee and Executive Committee concurred with this assessment and present the John Herr Lifetime Achievement Award to Jim Caponetti.

James D. Caponetti (second from left) receives the 2017 John Herr Lifetime Achievement Award from award committee chair Thomas R. Wentworth (far left). Dr. Caponetti is congratulated by his wife Marilyn (center) and by award committee members Patricia Cox (second from right) and Joseph Winstead (far right).

ASB Meritorious Teaching Award

No award was made this year.

ASB Lucrecia Herr Outstanding Biology Teacher Award

High School Teacher Honored

Presented to Ben Johnston
Bob Jones High School, Madison, Alabama

The 2017 Association of Southeastern Biologists Lucrecia Herr Outstanding Biology Teacher Award was presented to **Ben Johnston** of the Bob Jones High School in Madison, Alabama, at the 78th annual meeting of the Association in Montgomery, Alabama, by the committee chair Dr. Holly Boettger-Tong. This very prestigious award is sponsored by the Carolina Biological Supply Company, Burlington, North Carolina, includes a plaque, and a check for $750.00.

ASB Research Award Presentations

ASB Senior Research Award

No award was made this year.

ASB Student Research Award

The ASB Student Research Award, sponsored by ASB Patron Member Martin Microscope Company, Easley, South Carolina, was presented by award committee member Christopher Gissendanner to **Steven Gardner**, Department of Biology, Jacksonville State University, Jacksonville, Alabama, for his manuscript coauthored with George Cline, Nixon Mwebi, Department of Physical and Earth Sciences, and James Rayburn entitled "Developmental and interactive effects of arsenic and chromium to developing *Ambystoma maculatum* embryos: Toxicity, teratogenicity, and whole-body concentrations," and recently published (January, 2017) in the *Journal of Toxicology and Environmental Health*: Part A, Volume 80, pages 1-14. Link to the article is https://www.tandfonline.com/doi/full/10.1080/15287394.2016.1253514.

Steven gave an oral presentation at the annual meeting entitled "Developmental and interactive effects of arsenic and chromium to developing *Ambystoma maculatum* embryos: Toxicity, teratogenicity, and whole-body concentrations," abstract 85, meeting program page 17.

AUTOBIOGRAPHICAL SKETCH FOR STEVEN GARDNER

Steven Gardner is an alumnus of Jacksonville State University, having obtained his bachelor's degree in general chemistry and master's degree in biology. While earning his bachelor's degree in general chemistry, Steven discovered a passion for research, working to understand how pollution and anthropogenic activity may contribute to amphibian population declines. During his time as a student at JSU, Steven attended and presented at several scientific conferences including SETAC and ASB national meetings, as well as regional AAS, and Southeast Regional SETAC meetings. Steven's work using the African

clawed frog, *Xenopus laevis*, as a model organism to assess developmental toxicity of plasticizers was published in 2016, while he was working on his master's degree in biology.

Following his bachelor's degree, Steven taught introductory chemistry labs, as well as biochemistry labs, while working on his master's thesis, "Developmental Toxicity of Arsenic and Chromium and Interactive Effect to Developing *Ambystoma maculatum* Embryos: Toxicity, Teratogenicity, and Uptake." While finishing his master's at JSU, he was accepted to Auburn University where he began work on his Ph.D. in the fall of 2016, working to understand mechanisms behind the invasion success of the cane toad, *Rhinella marina*. He is currently developing an *in vitro* assay to measure T cell proliferation to assess cell mediated immune responses in amphibians, while learning how to assess genetic differences across populations of species using single nucleotide polymorphisms (SNPs).

In regard to his master's work, Steven was the primary author and made significant contributions to the manuscript, "Developmental and interactive effects of arsenic and chromium to developing *Ambyystoma maculatum* embryos: Toxicity, teratogenicity, and whole-body concentrations," including specimen and data collection, as well as data analysis.

Steven Gardner (left) receives the ASB Student Research Award from award committee chair Christopher Gissendanner.

ASB Student Oral Presentation Awards

Awards, sponsored by ASB, in four categories were presented to each of four students by award committee chair David Giles.

1. Animal Biology – An award in Animal Biology to **Robin Hauschner**, Department of Biology, Berea College, Berea, Kentucky, for his paper with coauthors entitled "Climate change and the effects of temperature on the release of *Proterometra macrostoma* (Trematoda:Digenes) cercariae from their snail intermediate host, *Pleurocera semicarinata* (Gastropoda:Pleuroceridae," abstract 37, meeting program page 16.

Robin Hauschner (left) receives the oral presentation award for best paper in Animal Biology from award committee chair David Giles.

2. Aquatic Biology – An award in Aquatic Biology to **Hannah Grice**, Department of Ecology, Evolution, and Organismal Biology, Kennesaw State University, Kennesaw, Georgia, for her paper with coauthors entitled "Effects on *Campostoma oligolepis* digestive morphology and gut microbiota composition across a gradient of urbanization," abstract 44, meeting program page 15.

Hannah Grice (left) receives the oral presentation award for best paper in Aquatic Biology from award committee chair David Giles.

3. Cell and Molecular Biology – An award in Cell and Molecular Biology to **Chathurani Ranathunge**, Department of Biological Sciences, Mississippi State University, Mississippi State, Mississippi, for her paper with coauthors entitled "Patterns of selection acting on transcribed and anonymous microsatellites in latitudinal populations of common sunflower (*Helianthus annuus* L.)," abstract 124, in meeting program page 19.

Chathurani Ranathunge (left) receives the oral presentation award for best paper in Cell and Molecular Biology from award committee chair David Giles.

4. Microbiology – An award in Microbiology to **Jordan Lewis**, Department of Biology, Winthrop University, Rock Hill, South Carolina, for his paper with coauthors entitled "The effects of coastal renourishment on the presence of *Escherichia coli*," abstract 22, meeting program page 15.

Jordan Lewis (left) receives the oral presentation award for best paper in Microbiology from award committee chair David Giles.

ASB Student Poster Presentation Awards

Awards, sponsored by ASB, in four categories were presented to each of four students by award committee chair David Giles.

1. Animal Biology – An award in Animal Biology to **Kristen T. Carlisle**, Department of Biology, Jacksonville State University, Jacksonville, Alabama, for her poster coauthored with James Rayburn entitled "Preliminary comparison of L-cystein, N-acetyl-cysteine, and apple peel protective effects on acrylamide toxicity in embryos of *Xenokus laevis*," abstract P071, meeting program page 24.

Kristen Carlisle (left) receives the poster presentation award for best poster in Animal Biology from award committee chair David Giles.

2. Aquatic Biology – An award in Aquatic Biology to **Cara Vielhauer**, Department of Biology, Middle Tennessee State University, Murfreesboro, Tennessee, for her poster with coauthors entitled "Identifying *Daphnia* species by morphological traits and DNA barcoding," abstract P143, meeting program page 27.

3. Cell and Molecular Biology – An award in Cell and Molecular Biology to **Josh Herman**, Department of Biology, Appalachian State University, Boone, North Carolina, for his poster coauthored with Andrew Bellemer entitled "The roles of G?Q and PLC in regulating mechanosensory and thermosensory behavior in *Drosophilia melanogaster*," abstract P217, meeting program page 29.

4. Microbiology – An award in Microbiology to **Kadiatou Keita**, Department of Biological and Environmental Sciences, Alabama A&M University, Normal, Alabama, for his poster with coauthors entitled "Multiwalled carbon nanotube effects on soil microbes and plant growth," abstract P114, meeting program page 26.

ASB Graduate Student Support Awards

The following 17 graduate students received $4,930 in support awards from ASB to attend the annual meeting in Montgomery, Alabama. Selections were made by the ASB Graduate Student Support Awards Committee members Beverly Collins (chair), Matt Estep, and Jonas King. These awards are sponsored by the ASB Silent Auction.

1. **Isaiah Amos**, Department of Biological Sciences, Old Dominion University, Norfolk, Virginia. Advisor, Dr. Lytton Musselman.
2. **Emily Brown**, Department of Biological Sciences, University of Alabama, Tuscaloosa, Alabama. Advisor, Dr. Paige Ferguson.
3. **Penny Carroll**, Department of Biology, Middle Tennessee State University, Murfreesboro, Tennessee. Advisor, Dr. Kimberly Sadler.
4. **Neil Gilbert**, Department of Biological Sciences, University of Alabama, Tuscaloosa, Alabama. Advisor, Dr. Paige Ferguson.
5. **Hannah Grice**, Department of Ecology, Evolution, and Organismal Biology, Kennesaw State University, Kennesaw, Georgia. Advisor, Dr. William Ensign.
6. **Nikolai Hay**, Department of Biology, Austin Peay State University, Clarksville, Tennessee. Advisor, Dr. Matt Estep.
7. **Nathan Katlein**, Department of Biology, University of South Alabama, Mobile, Alabama. Advisor, Dr. Y. Chiani.
8. **Chelsea Miller**, Department of Ecology and Evolutionary Biology, University of Tennessee, Knoxville, Tennessee. Advisor, Dr. Charles Kwit.
9. **Hannah Mullally**, Department of Ecology and Evolutionary Biology, University of Tennessee, Knoxville, Tennessee. Advisor, Dr. Charles Kwit.
10. **Daniel Nielson**, Department of Biology, Appalachian State University, Boone, North Carolina. Advisor, Dr. Howard Neufeld.
11. **Tyler Porter**, Department of Biology, University of Louisiana, Monroe, Louisiana. Advisor, Dr. Kim Marie Tolson.
12. **Adam Ramsey**, Department of Biological Sciences, University of Memphis, Memphis, Tennessee. Advisor, Dr. Jennifer Mandel.
13. **Chathurani Ranathunge**, Department of Biological Sciences, Mississippi State University, Mississippi State, Mississippi. Advisor, Dr. Mark Welch.
14. **Carolina Siniscalchi**, Department of Biological Sciences, University of Memphis, Memphis, Tennessee. Advisor, Dr. Jennifer Mandel.
15. **Eranga Wettewa**, Department of Biological Sciences, Mississippi State University, Mississippi State, Mississippi. Advisor, Dr. Lisa Wallace.
16. **James Wood**, Odum School of Ecology, University of Georgia, Athens, Georgia. Advisor, Dr. Mary Freeman.
17. **Lauren Wood**, Department of Environmental Studies, Virginia Commonwealth University, Richmond, Virginia. Advisor, Dr. Julie Zinnert.

ASB First Generation Undergraduate Student Travel Scholarships

The following five undergraduate students received $1,450 in travel funds from ASB to attend the annual meeting in Montgomery, Alabama. Each student also received a ticket of admission to the committee luncheon. Selections were made by the ASB Committee on Human Diversity members Jay Bolin (co-chair), Loretta Adoghe (co-chair), Alfredo Leon, Valerie Burnett, Veronica Sergarra, Jeffrey Thomas, and Bahohorg Zhang. These awards are sponsored by the ASB Committee on Human Diversity.

1. **Ines Bibiano Baltazar**, Department of Biology, Reinhardt University, Waleska, Georgia.
2. **Shannon Gilstrap**, Department of Biology and Environmental Sciences, Samford University, Birmingham, Alabama.
3. **Aakash Nawaz**, Department of Biology, High Point University, High Point, North Carolina.
4. **Amy Williams**, Department of Biology, Reinhardt University, Waleska, Georgia.
5. **Dieff Vital**, Department of Science and Technology Management, Florida Polytechnic University, Lakeland, Florida.

Eugene P. Odum Award

The Eugene P. Odum Award, sponsored by the Southeastern Chapter of the Ecological Society of America, was presented by award committee chair Christopher Adams to two recipients: (1) **Lauren Whitehurst**, Department of Biology, Columbus State University, Columbus, Georgia, for her paper with coauthors entitled "Implementing a DNA barcoding pipeline to prevent the introduction of invasive species into the Port of Savannah," abstract 92, meeting program page 18; and (2) **David Nielsen**, Department of Biology, Appalachian State University, Boone, North Carolina, for his paper with coauthors entitled "Mechanisms driving the asymmetrical distribution of *Polystichum acrostichoides* (Christmas fern) on North/South Ridges in a Southern Appalachian woodland," abstract 104, meeting program page 19.

Elsie Quarterman-Catherine Keever Award

The Elsie Quarterman-Catherine Keever Award, sponsored by the Southeastern Chapter of the Ecological Society of America, was presented by award committee chair David Vandermast to **Maggie Howard**, Department of Biology, Georgia Southern University, Statesboro, Georgia, for her poster coauthored with J. Scott Harrison entitled "Inbreeding depression in the introduced spider *Latrodectus geometricus*," abstract P179, meeting program page 28.

Maggie Howard (left) receives the Elsie Quarterman-Catherine Keever Award from award committee chair David Vadermast.

THE NORTH CAROLINA BOTANICAL GARDEN AWARD

The North Carolina Botanical Garden Award, sponsored by the NCBG, Chapel Hill, North Carolina, was presented by award committee member Amanda Faucette to **Lauren Whitehurst**, Department of Biology, Columbus State University, Columbus, Georgia, for her paper with coauthors entitled "Implementing a DNA barcoding pipeline to prevent the introduction of invasive species into the Port of Savannah, abstract 92, meeting program page 18.

BOTANICAL SOCIETY OF AMERICA

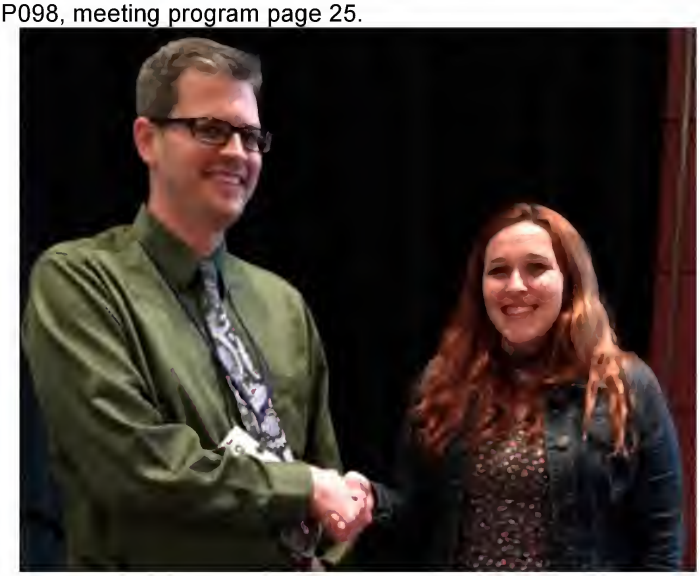
SOUTHEASTERN SECTION STUDENT AWARDS IN PLANT SCIENCE

The Botanical Society of America Southeastern Section Student Awards, sponsored by the SE Section of the BSA, presented two awards—one for best paper presentation and one for best poster presentation. Both awards were presented by award committee chair Christopher Havran.

1. Paper Presentation – to **Chathurani Ranathunge**, Department of Biological Sciences, Mississippi State University, Mississippi State, Mississippi, for her paper with coauthors entitled "Patterns of selection acting on transcribed and anonymous microsatellites on latitudinal populations of common sunflower (*Helianthus annuus* L.)," abstract 124, meeting program page 19.

Chathurani Ranathunge (left) receives the BSA SE Section student paper award from award committee chair Christopher Havran.

2. Poster Presentation – to **Carolina Siniscalchi**, Department of Biological Sciences, University of Memphis, Memphis, Tennessee, for her poster coauthored with Jennifer Mandel entitled "Development of SSR markers for *Chresta* (Asteraceae, Vernonicae) using genomic data," abstract P098, meeting program page 25.



Carolina Siniscalchi (right) receives the BSA SE Section student poster award from award committee chair Christopher Havran.

SOUTHERN APPALACHIAN BOTANICAL SOCIETY AWARDS

Presented on March 31, 2017, at the Annual SABS/BSA Breakfast Meeting

Student Presentation Awards

The Student Presentation Awards were established to reward outstanding undergraduate or graduate student botanical presentations at the annual Association of Southeastern Biologists meeting. For 2017, awards were presented for the best student poster presentation and for best oral presentation. Each award includes an honorarium of $300.

Student Poster – **Carolina Siniscalchi** (University of Memphis) – "Development of SSR markers for *Chresta* (Asteraceae: Vernonieae) using genomic data," abstract P098, meeting program page 25. (Coauthored with Jennifer Mandel.)

Student Oral Presentation – **Lauren Whitehurst** (Columbus State University) – "Implementing a DNA barcoding pipeline to prevent the introduction of invasive species into the Port of Savannah," abstract 92, meeting program page 18.

Carolina Siniscalchi (right) receives the award for best student poster presentation from Charles Havran, President of SABS.

Earl Core Student Research Award

Dr. Earl Core was a major force in the founding of the Southern Appalachian Botanical Club in 1936. The annual Core Student Award was established by the society to provide financial assistance in support of student research projects in plant taxonomy, systematics, and ecology. This year two proposals were funded.

Adam Ramsey (University of Memphis) – "The effects of mitochondrial heteroplasmy on individual fitness in wild carrot." The funding amount is $640.00. His research advisor is Jennifer Mandel.

Jennifer Hastings (Ohio University) – "Comparative ecology and niche differentiation of three new mid-Appalachian acaulescent blue violet species." The funding amount is $737.55. Her research advisor is Harvey Ballard.

Richard and Minnie Windler Award

The Richard and Minnie Windler Award was established in 1990 at the annual meeting of the SABS by Dr. Donald R. Windler of Towson University as a memorial to his parents. Two awards are now presented annually: first to the author or authors of the best systematic botany paper, and second for the best ecology or floristic paper, both published in *Castanea* during the previous year. Each award comes with a check for $500.

The 2017 Richard and Minnie Windler Award winners for the best systematics botany paper published in *Castanea* during 2016 were

Ecology – **Varma-Rose J. Williams** and **Heather F. Sahli** for their paper "A comparison of herbivore damage on three invasive plants and their native congeners: Implications for the enemy release hypothesis." The article was published in the June 2016 issue.

Systematics – **Jonathan P. Evans, Callie A. Oldfield, Mary P. Priestley, Yolande M. Gottfried, L. Dwayne Estes, Alfire Sidik**, and **George S. Ramseur** for their paper "The vascular flora of the University of the South, Sewanee, Tennessee." The article was published in the September issue.

Elizabeth Ann Bartholomew Award

The society annually presents the award in memory of Elizabeth Ann Bartholomew's untiring service to the public, to plant systematics, and to the organization. The award is presented to individuals who have also distinguished themselves in professional and public service that advances our knowledge and appreciation of the world of plants and their scientific, cultural, and aesthetic values, or exceptional service to the society.

For 2017 this award was presented to **Dr. Conley K. McMullen** for his outstanding contributions to education, outreach and service to the society. Conley is Professor of Biology at James Madison University where he has dedicated a career to teaching, advising graduate students and curating the herbarium. His research relates to the flora of Virginia and of the Galapagos Islands. He has served as president of SABS. A detailed presentation of his accomplishments can be found in the fall 2017 issue of *Castanea*.

Conley K. McMullen (right) receives the Elizabeth Ann Bartholomew Award from award committee chair Thomas R. Wentworth.

Dr. McMullen (right) expresses his appreciation on receiving the award.

Student Travel Awards

This is an award to assist students attending the Association of Southeastern Biologists (ASB) meeting each year. The award is available to undergraduate and graduate students presenting a paper of poster with a botanical focus at the annual ASB/SABS meeting. The 2017 awardees are **Cameron Byrd** (Troy University), **Nikolai Hay** (Appalachian State University), **Anna Nichole Long-Aragon** (University of Southern Mississippi), **Adam Ramsey** (University of Memphis), **Eranga Wettewa** (Mississippi State University), and **James Wood** (University of Georgia).

ASB Past Presidents at the Annual Meeting in Montgomery, Alabama

Seated from left to right: Zack Murrell, Thomas Wentworth, Joey Shaw, Patricia Cox, Joseph Winstead, and Andrew Ash. Standing from left to right: Michael Dennis, Dwayne Wise, Michael Baranski, Kenneth Shull, Patricia Parr, Raymond Flagg, Kim Marie Tolson, and Howard Neufeld.

EXHIBIT HALL REGISTRATION

Registration desk. Shannon Oliphant-Gordon (right) and her husband David.

Registration desk. Andrew Asante (left) and Kathy Norton.

EXHIBITORS AT THE ANNUAL MEETING

Booth No. 1. Alabama State University

Booth No. 2. Troy University

EXHIBITORS AT THE ANNUAL MEETING

Booth No. 3. University of Georgia Press

Booth No. 4. Eagle Hill Institute – Joerg-Henner Lotze, Director of the Institute and Publisher of several journals.

EXHIBITORS AT THE ANNUAL MEETING

Booth No. 5. Association of Southeastern Biologists. Treasurer Edgar Lickey (seated left) and James D. Caponetti, Print Editor (seated right).

Booth No. 7. Southern Appalachian Botanical Society. President Charles Horn (center) and Treasurer Kunsiri (Pum) Grubbs (seated right).

EXHIBITORS AT THE ANNUAL MEETING

Booth No. 8. Western Carolina University. Katherine Mathews (right).

Booth No. 9. James Madison University. Tending the booth (from left to right) are students Matthews Elder (standing), Jessie Mandirola, and Kelly Livernoche.

EXHIBITORS AT THE ANNUAL MEETING

Booth No. 10. University of Southern Mississippi.

Booth No. 11. Middle Tennessee State University.

EXHIBITORS AT THE ANNUAL MEETING

Booth No. 13. Kennesaw State University.

Booth No. 14. University of Tennessee at Chattanooga.

EXHIBITORS AT THE ANNUAL MEETING

Booth No. 16. National Association of Biology Teachers.

Booth No. 17. Associated Microscope.

EXHIBITORS AT THE ANNUAL MEETING

Booth No. 19. Vashaw Scientific, Inc.

Booths Nos. 20 and 21. Fine Designs – A T-shirt company.

EXHIBITORS AT THE ANNUAL MEETING

Booth 22. Forestry Supplies, Inc.

Booth 24. Medical Incorporated – Todd Fentress.

EXHIBITORS AT THE ANNUAL MEETING

Booth No. 25. Alabama Department of Environmental Management (ADEM).

Booth 26. Martin Microscope – Robert Martin, Jr. (right), owner.

EXHIBIT HALL ATTENDEES

James Madison University Biology Department graduate students. From left to right: Matthew Elder, Jessie Mandirola, Matthew Harris, and Kelly Livernoche.

From left to right: Michael Held, Ruth Douglas, and Joseph Winstead.

Exhibit Hall Attendees

Lytton Musselman (left) and Mac Alford.

From left to right: Conley McMullen, Michael Baranski, Charles Horn, and Ruth Douglas.

EXHIBIT HALL ATTENDEES

Seated from left to right: ASB Past Presidents Andrew Ash, Patricia Parr, Joseph Winstead, and Kim Marie Tolson.

Exhibit Hall Attendees

ASB Past Presidents Michael Dennis (standing) and Patricia Cox.

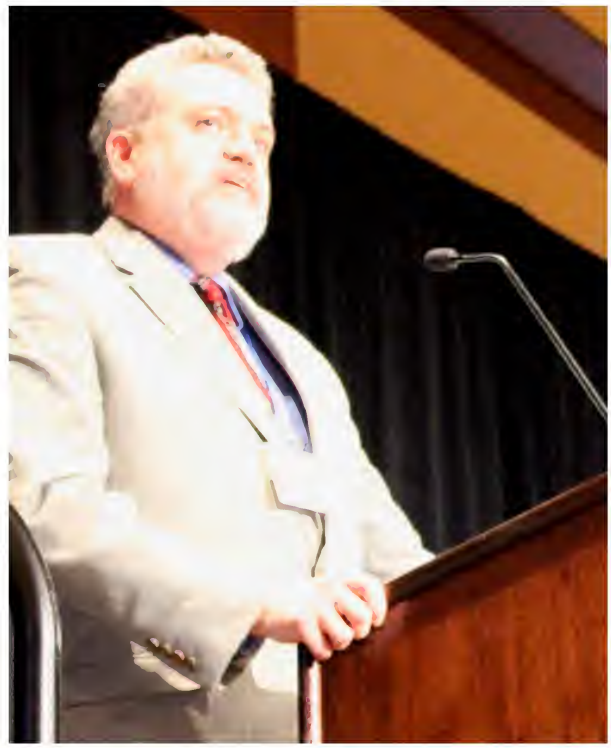
Exhibit Hall Attendees

THE ASB PLENARY SESSION
WEDNESDAY, MARCH 29, 2017

The Plenary Session was held in rooms Alabama A and B of the Conference Center in the Renaissance Montgomery Hotel and Spa. The session was opened by ASB President Dr. Joey Shaw at 7:30 PM CDST. The audience was welcomed by (1) Dr. Karyn Scissum-Gunn, Interim Provost and Vice President of Academic Affairs, Alabama State University, Montgomery, Alabama, and by (2) Dr. Steven Taylor, Dean of the College of Arts and Sciences, Troy University, Troy, Alabama. Dr. Shaw then introduced Dr. William Luther, Provost and Vice President for Academic Affairs, Tuskegee University, Tuskegee, Alabama. Dr. Luther then introduced the plenary speaker Dr. Lafayette Frederick, Tuskegee University Distinguished Alumnus and Life Mentor Award Recipient, AAAS Lifetime Achievement Award, and ASB Lifetime Achievement Award. The title of his talk was *Impact of ASB on the Development of Minority Biologists from the Southeast*.

Dr. Joey Shaw.

Dr. Karyn Scissum-Gunn.



Dr. Steven Taylor.

Dr. William Luther.

Dr. Lafayette Frederick.

ASB President-Elect Ashley Morris (left) thanks Dr. Frederick for an inspirational talk.

THURSDAY SILENT AUCTION
ORGANIZED AND CONDUCTED BY "THE ASB SISTERS"

From left to right: Diane Nelson, Patricia Parr, Kim Marie Tolson, Patricia Cox, and Eloise Carter

Selecting and bidding.

THURSDAY SILENT AUCTION
ORGANIZED AND CONDUCTED BY "THE ASB SISTERS"

Selecting and bidding.

Selecting and bidding. Holly Boettger-Tong.

THURSDAY SILENT AUCTION
ORGANIZED AND CONDUCTED BY "THE ASB SISTERS"

Selecting and bidding

Selecting and bidding

Society of Herbarium Curators
Thursday SE Chapter Luncheon and Business Meeting

Chapter President Austin Mast presents a report.

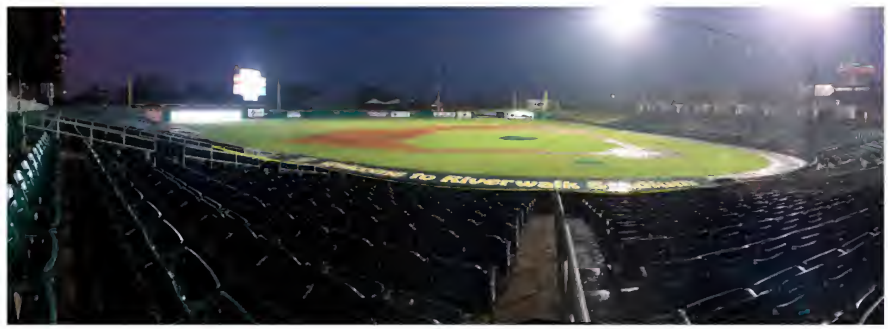
Chapter meeting attendees.

Society of Herbarium Curators
Thursday SE Chapter Luncheon and Business Meeting

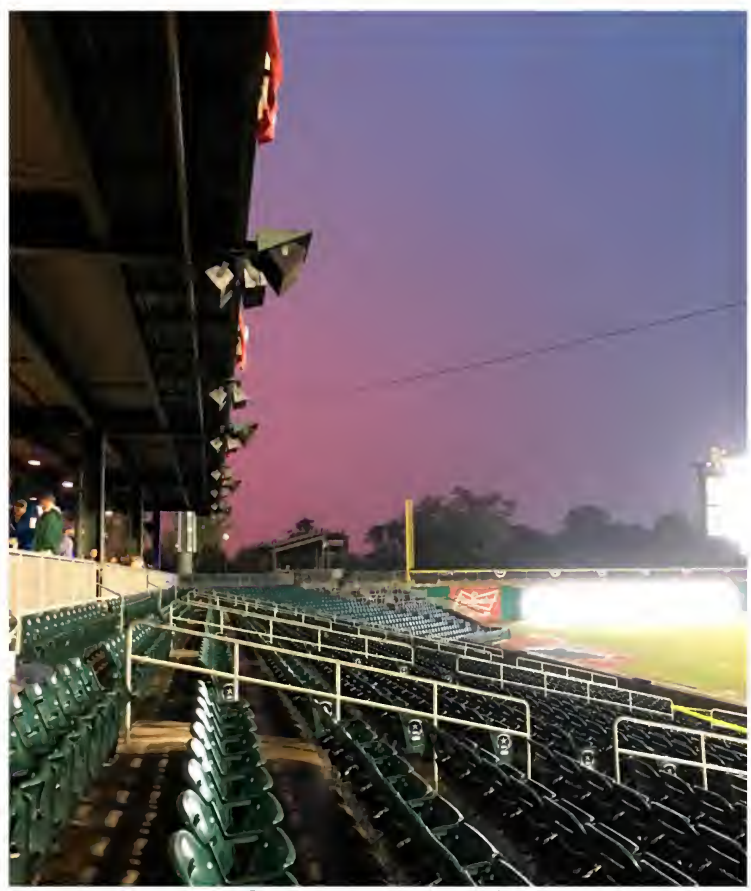
Chapter meeting attendees

Chapter meeting attendees.

THURSDAY NIGHT ASB SOCIAL
RIVERWALK STADIUM—HOME OF THE BISCUITS BASEBALL TEAM



Riverwalk Stadium



Riverwalk Stadium-thunderstorm in progress.

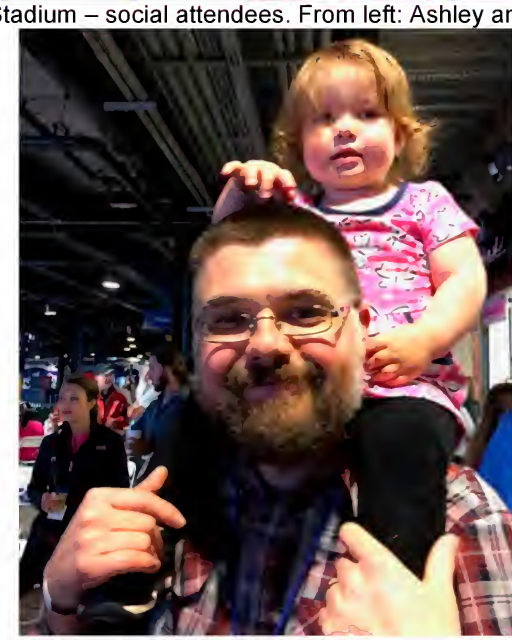
THURSDAY NIGHT ASB SOCIAL
RIVERWALK STADIUM—HOME OF THE BISCUITS BASEBALL TEAM

Riverwalk Stadium – social attendees

Riverwalk Stadium – social attendees

Thursday Night ASB Social
Riverwalk Stadium—Home of the Biscuits Baseball Team

Riverwalk Stadium – social attendees. From left: Ashley and Ada Morris.



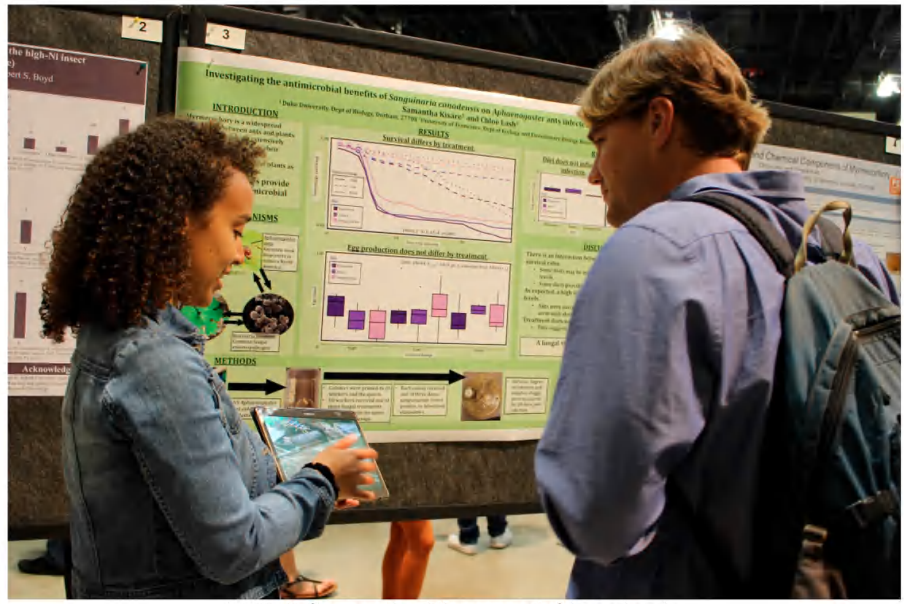
From left; Chris and Ada Morris.

THURSDAY NIGHT ASB SOCIAL
RIVERWALK STADIUM—HOME OF THE BISCUITS BASEBALL TEAM

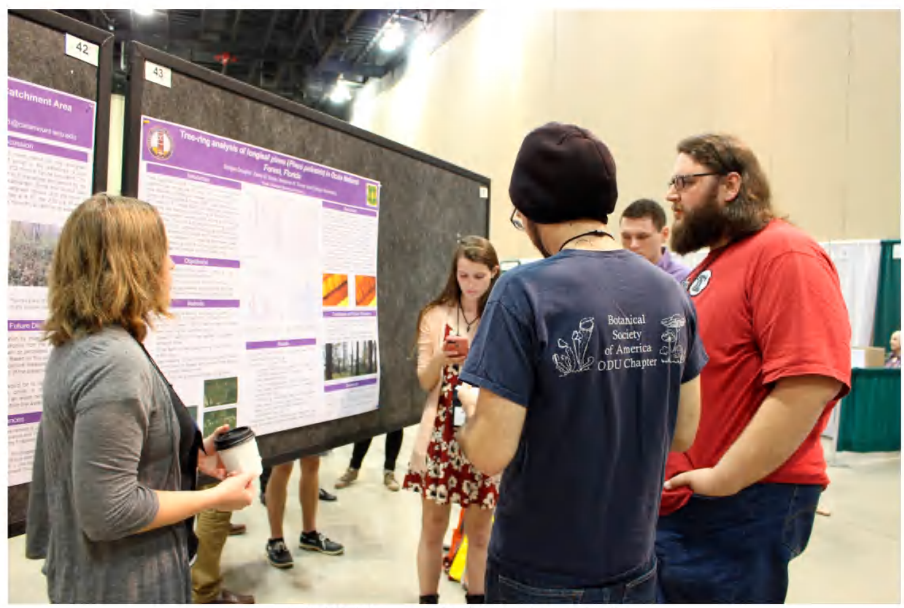
Riverwalk Stadium – social attendees. Background from left to right: Aiden Shaw, Joey Shaw, and Jesse Harris. Foreground (children) from left to right: Samuel Morris and Jackson Morris.

Riverwalk Stadium – social – the band.

THURSDAY AND FRIDAY ASB POSTER SESSIONS

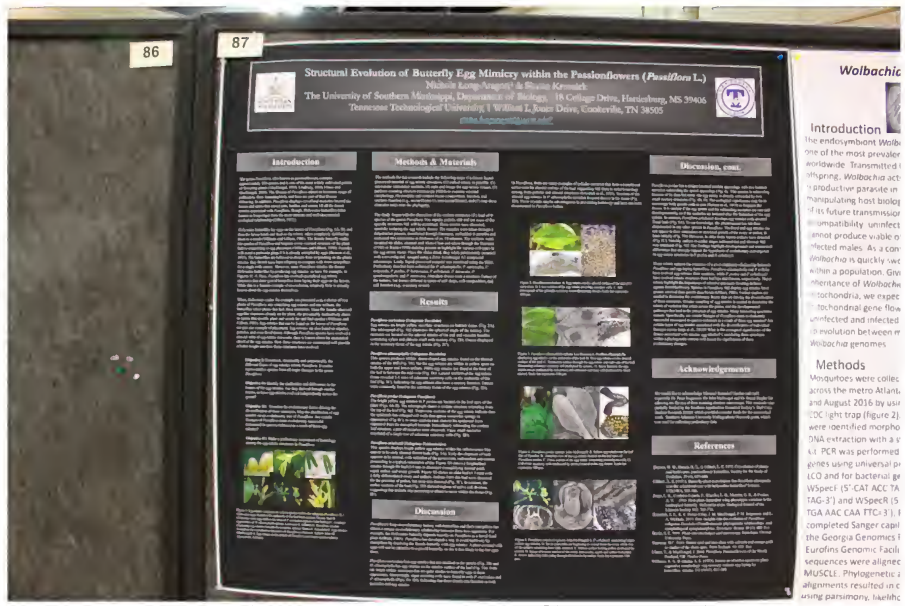


P0003 Samantha Kisare and Chloe Lash.

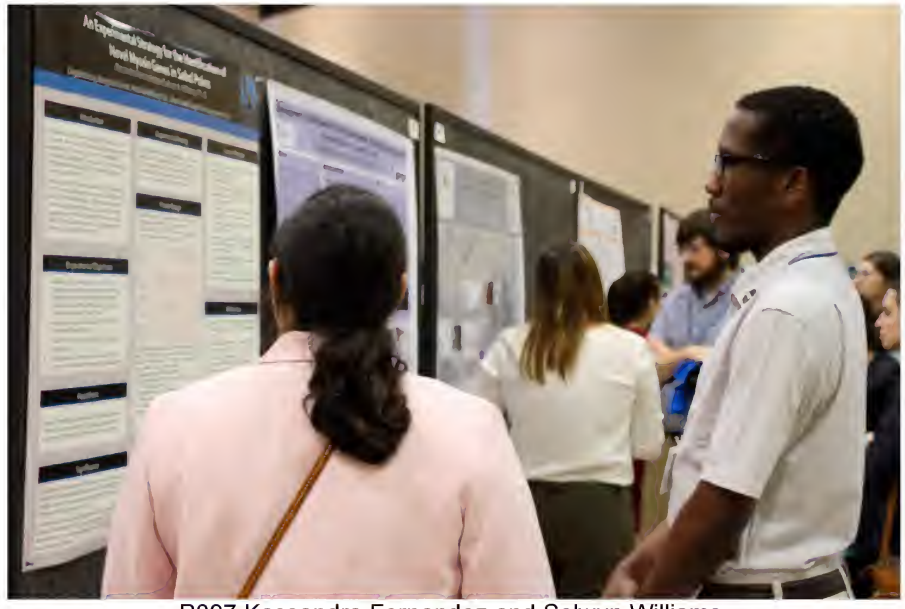


P043 Morgan L. Douglas et al.

THURSDAY AND FRIDAY ASB POSTER SESSIONS



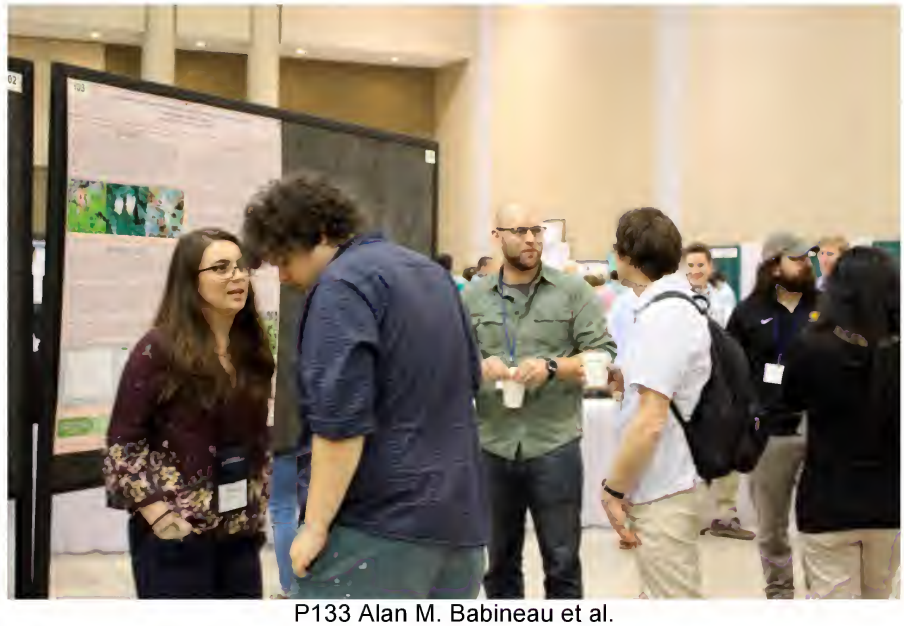
P087 Nichole Long-Aragon and Shawn Krosnick.



P097 Kassandra Fernandez and Selwyn Williams.

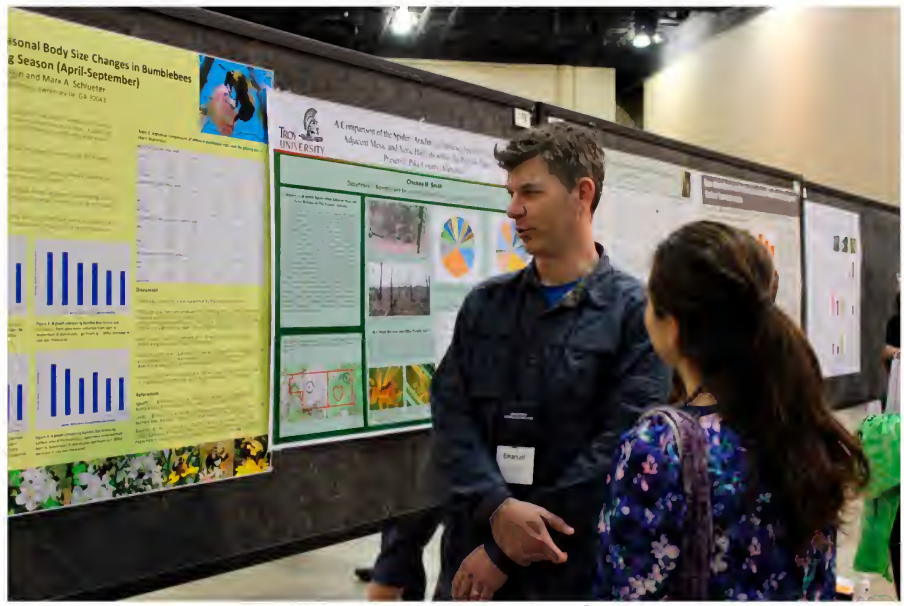
THURSDAY AND FRIDAY ASB POSTER SESSIONS

P111 Caitlyn Johnson et al.

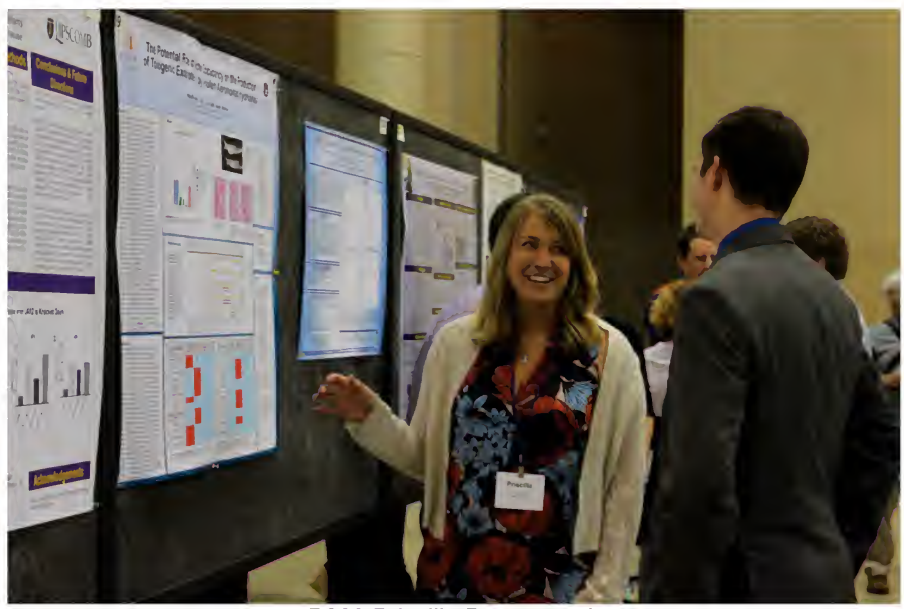


P133 Alan M. Babineau et al.

THURSDAY AND FRIDAY ASB POSTER SESSIONS

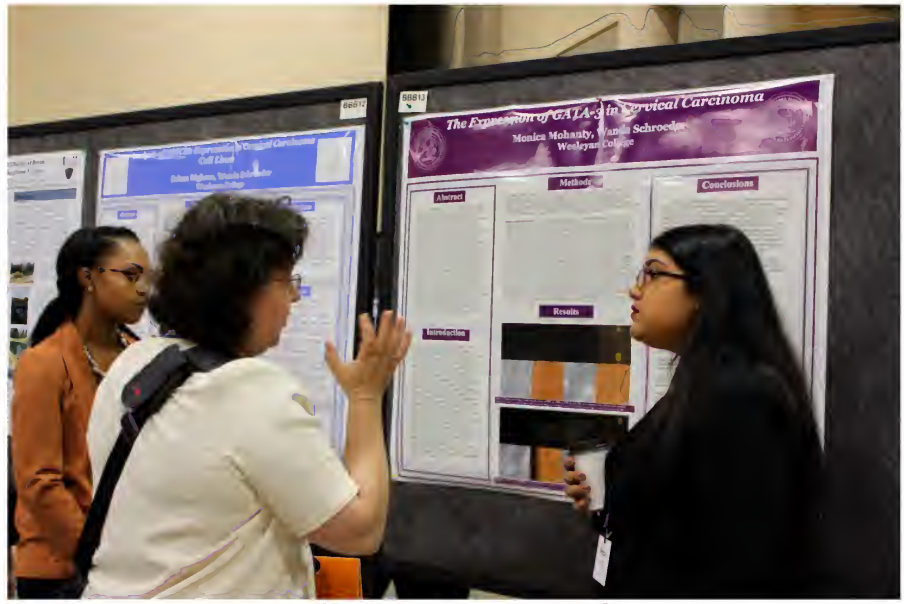


P177 Emanuel Harbin and Mark Schlueter.

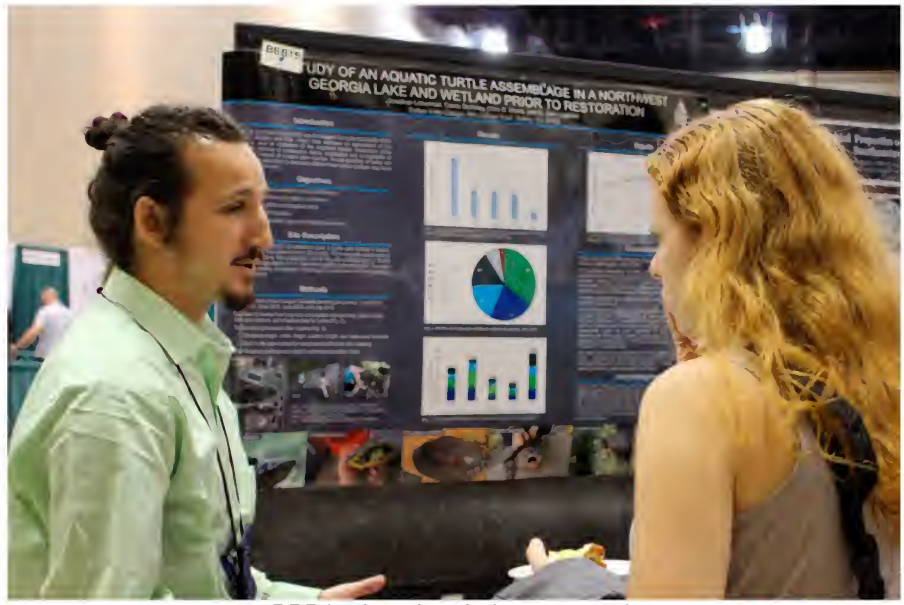


P229 Priscilla Barger et al.

FRIDAY BETA BETA BETA POSTER SESSIONS

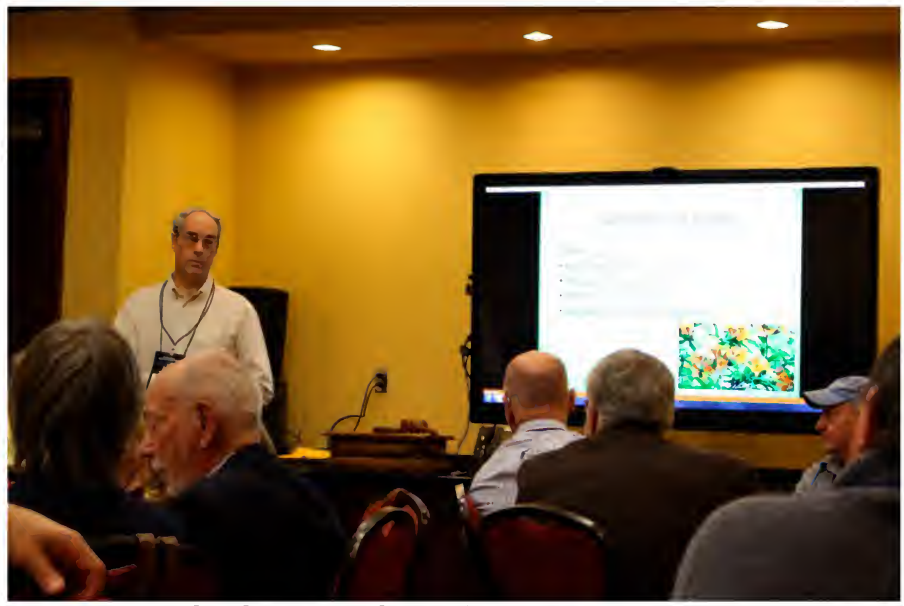


BBB13 Monica Mohanty and Wanda Schroeder.



BBB15 Jonathan Leberman et al.

FRIDAY SABS/BSA BREAKFAST MEETING



SABS President Charles Horn presents a report.

SABS Treasurer Kunsiri (Pum) Grubbs presents a report.

FRIDAY SABS/BSA BREAKFAST MEETING

SABS Membership Secretary Michael Held presents a report.

SABS Editor-in-Chief of *Castanea* Christopher Randle presents a report.

FRIDAY SABS/BSA BREAKFAST MEETING

SABS Past President Katherine Mathews presents a report.

SABS newly elected President-Elect Brian Keener presents a report.

FRIDAY SABS/BSA BREAKFAST MEETING

Meeting attendees.

Meeting attendees – Christopher Havran (left) and Howard Neufeld.

FRIDAY SABS/BSA BREAKFAST MEETING

Meeting attendees (from right to left): Edgar Lickey, Joey Shaw, and Jennifer.

Meeting attendees.

FRIDAY SABS/BSA BREAKFAST MEETING

Meeting attendees.

Meeting attendees.

FRIDAY SABS/BSA BREAKFAST MEETING

BSA Southeastern Section Chairman Christopher Havran presents a report.

BSA Southeastern Section Secretary/Treasurer Emily Gillespie presents a report.

RESOLUTION OF APPRECIATION TO

ALABAMA STATE UNIVERSITY, TROY UNIVERSITY, RENAISSANCE MONTGOMERY HOTEL AND SPA STAFF AND THE ORGANIZERS OF THE 78TH ANNUAL MEETING OF THE ASSOCIATION OF SOUTHEASTERN BIOLOGISTS

WHEREAS, Alabama State University and Troy University did agree to host the Association of Southeastern Biologists during the 78th Annual Meeting on March 29 through April 1, 2017, and

WHEREAS, the Annual Meeting Arrangement Committee co-chaired by Joey Shaw and Ashley Morris, and ASB Executive Committee Members Judy Awong-Taylor, Peggy Kovach, Ricky Florillo and Chris Havran worked with the Program Committee, and

WHEREAS, Chris Brown and Rickey Florillo from Georgia Gwinnett College and Howie Neufeld from Appalachian State University, for assembling the program and submission of abstracts; Chris Fleming of BDY Environmental for the creation of the program applications available for mobile devices; Christi Magrath of Troy University and Lee Sutton of East Carolina University for coordinating the activities of Beta Beta Beta, Ashley Morris of Middle Tennessee State University and Chris Fleming of BDY Environmental for their excellent work on the ASB web and social media pages, Peggy Kovach and Chris Havran for organizing the volunteers; Patricia Cox, Kim Tolson, Patricia Parr, Bonnie Kelley, and Eloisse Carter for organizing the silent auction; Emily Gillespie, Bill Ensign, Davy Giles and Mark Shorr for coordinating the awards, Experient for online and on-site registration; Ashley Morris for handling commercial exhibits and workshops; the staff of Riverview Stadium for hosting the Friday Night ASB Social, Shannon Oliphant-Gordon of Experient for assisting with all aspects of meeting planning and execution, Jesse Harris, and Alaina Krakowiak for assisting the President; and the members of the ASB Executive Committee for all their efforts to make this meeting a success, and

WHEREAS, the affiliate societies TriBeta Southeastern District I, TriBeta Southeastern District II, Southeastern Section of the Botanical Society of America, Southeastern Chapter of the Ecological Society of America, Southeast Chapter of the Society of Herbarium Curators, and Southern Appalachian Botanical Society, our patron members, Breedlove, Dennis & Associates, Inc., and Dwayne Wise and our exhibitors, Alabama Department of Environmental Management, Alabama State University, Associated Microscopes, Carolina Biological Supply Company, Eagle Hill Publishers, Fine Designs, Forestry Suppliers, Inc., Georgia Southern University, James Madison University, Kennesaw State University, Martin Microscopes, Middle Tennessee State University, National Association of Biology Teachers, Southern Appalachian Botanical Society, Medical, Inc., National Association of Biology Teachers, Tri-Beta National Undergraduate Honors Society, Troy University, University of Georgia Press, University of Alabama Press, University of Tennessee Chattanooga, University of Southern Mississippi, Vashaw Scientific, Inc., and Western Carolina University, were in attendance and contributed to paper and poster sessions, workshops, and symposia; and

WHEREAS, the citizenry of Montgomery, Alabama, cooperated to welcome the Association of Southeastern Biologists to the City of Montgomery; therefore, be it

RESOLVED, that the members of the Executive Committee of the Association of Southeastern Biologists give their sincere thanks and appreciation to all involved in making this an excellent and memorable Annual Meeting that resulted from the cumulative efforts of these individuals and organizations.

ORAL PRESENTATIONS

1 How to create opportunities in research, education, and outreach through the formation of an undergraduate Herbarium Army

Lena Struwe, Megan King. Rutgers University, Ecology, Evolution, and Natural Resources, New Brunswick, NJ, 8901

Herbaria and other scientific collections at universities and colleges are often underfunded and poorly staffed while having highly valuable research specimens. At the same time, these institutions have students that are looking for internship opportunities that provide meaningful, skills-based training and experiences for future careers. At Rutgers University in New Jersey, home to the Chrysler Herbarium with about 200 000 specimens, we started the Herbarium Army in January 2016 to find a solution to these two needs. Two-thirds of the angiosperms have so far been rearranged into the APG system, which involves a total reorganization. Every scientific name was checked against databases to provide the most recent accepted name and family placement, repairs where done, and all collections was reorganized into the new alphabetized order. Unidentified specimens were identified, new accessions mounted and stamped with accession numbers, and labels were made and type specimens were discovered and confirmed. In assessments students enhanced the value of their experiences not only from a biological perspective (learned about plants, how to identify, about nomenclature, etc.), but also improved general life and career skills such as working and collaborate in teams, read handwriting, provide detailed and careful work, and organize and plan projects. Literacy in history, biology, and geography has increased, and the experience has helped students gain employment after graduation. During 2016, about 20 students volunteered or worked (for credit) for 2500+ hours and their impact has been revolutionary. This has also helped us to increase our funding, both from internal and external sources. The Herbarium Army will be an integral part of our new NSF-digitization grant focused on the Mid-Atlantic Megalopolis flora. Our program now also includes a certificate in training in Scientific Collections Management, and we are now adding photography, databasing, and geolocation skills to students' skill portfolios.

2 Lessons learned in building educational networks that incorporate natural history collections

Anna Monfils, Central Michigan University, Biology, Mt. Pleasant, MI, 48858

Much of modern science is conducted through collaboration. With the influx of new data resources and associated tools and technology, the modern systematists find themselves confronted with expanded tasks, new skill requirements, and a broader set of disciplines to assimilate. To be successful we need to collaborate broadly across institutions and disciplines, and this is particularly true for faculty at smaller institutions who may have additional challenges when connecting to the research and education community. Educational initiatives within the herbarium and digitization networks have given rise to materials that can facilitate undergraduate education and workforce training and several successful collaborations have resulted in some "best practices" for developing and disseminating educational materials. Results from community surveys have indicated ongoing needs and some potential future directions. New and emerging educational resources and initiatives will be introduced, a suite of "best practices" will be highlighted, and ongoing and future needs will be presented. Looking to the future of collections based educational materials, Biodiversity Literacy in Undergraduate Education (BLUE) will be introduced with a call to grow and build a collaborative network.

3 ADBC and iDigBio: Advances in Herbarium Digitization
Gil Nelson, iDigBio/Florida State University, Tallahassee, Florida, 32306

With the National Science Foundation's launch in 2011 of the Advancing Digitization of Biodiversity Collections (ADBC) initiative, the pace of herbarium digitization in the Southeast has grown exponentially. From early efforts, such as the Deep South Plant Specimen Imaging Project and The GA-VSC Herbaria Collaborative, to the more recent Keys to the Cabinets Thematic Collections Network with over 100 collaborating institutions from the Southeast, the availability of aggregated plant specimen data through the iDigBio and SERNEC portals is opening up new opportunities for research and discovery. This presentation will offer a brief history of ADBC and iDigBio, summarize successes to date, and suggest future challenges in carrying digitization efforts forward

4 Survival at a Small Regional University
Richard Carter, Valdosta State University, Biology, Valdosta, Georgia, 31698

Located at a small state university, the Valdosta State University Herbarium (VSC) is an important regional biodiversity collection. Valdosta State University places heavy emphasis on undergraduate teaching, with normal teaching obligations leaving little time for research and curation. Despite this, VSC has grown consistently over the past three decades. The vouchers accounting for this growth are mostly from floristic and rare plant inventories carried out by the curator through field work supported from diverse sources. During 2011 - 2014, VSC holdings were digitized with support from the National Science Foundation, bringing a new and valuable dimension to the herbarium. Much of the curatorial work and digitization was performed by undergraduates who were also involved in diverse outreach activities promoting VSC and the importance of biodiversity collections in research. VSC outreach involves the campus community at large, K-12 students, local civic groups, and adult learners. In 2015, a high-density storage system was installed through support from the National Science Foundation. In addition to providing much needed space for storage of specimens, this grant has continued processing and digitizing valuable biodiversity vouchers from throughout southern Georgia. Much of VSC's success is attributed to: (1) persistence in pursuing locally and regionally focused research activities that enable accumulation of voucher specimens for the herbarium; (2) networking with botanists and others in the region willing to provide expertise and to collaborate on projects enhancing the herbarium; (3) promoting the herbarium not only as essential in providing the foundation for biological research but also as a valuable teaching and learning resource; and (4) aggressively seizing opportunities that advance the mission of the herbarium.

5 The Dynamic Herbarium: Add some Zest to your Presentations!
Wendy Zomlefer, University of Georgia, Plant Biology Department, Athens, Georgia, 30602

Herbarium curators often give presentations about their facilities to the general public (including potential donors!), various stakeholders, and others with little background in biology. These service activities are wonderful opportunities to educate laypeople about the importance of natural history collections. This talk will highlight suggestions for enlivening a presentation to convey most effectively the dynamism of herbaria that are so much more than just collections of flattened dried plants. Humorous and appealing herbarium lore will set the stage for an entertaining demonstration, followed by images or actual specimens that are unique or odd: every collection has some! Field stories coupled with photographs of real plant collection pursuits emphasize the source of the specimens and the time and effort

involved in procuring the materials used in creating a beautifully pressed and mounted herbarium sheet bearing complete label data and the correct identification. Images of pristine rooms with orderly rows of herbarium cases come alive when they include students and others busily occupied with various curatorial tasks; this adds a personal dimension and emphasizes the vibrancy of the facility. Depicting herbarium outreach activities -- with busy hands and eager faces of children and students and adults of all ages within the herbarium facility or elsewhere -- imparts a vital dimension to the herbarium as a valuable educational resource.

6 **A Multi-Year Project Demonstrates that Botany-naïve Undergraduates Are Critical Partners in Herbarium Digitization Efforts**

Emily Gillespie, Marshall University, Biological Sciences, Huntington, West Virginia, 25755

Digitization efforts by the NSF-supported SERNEC-TCN collaborative, "Key to the cabinets: Building and Sustaining a Research Database for a Global Biodiversity Hotspot" is now in its third year of funding. This 12-state collaborative effort is working to digitize and mobilize data from several million herbarium specimens from the Southeastern United States in order to facilitate future research efforts using across a wide range of disciplines. Establishing 'best practices' to streamline future digitization efforts in support of this broader goal is an important part of the SERNEC project. Many collections have limited budgets and staffing options. The Marshall University Herbarium (MUHW), a collection of approximately 50,000 vascular plant specimens and smaller collections of fungi, algae, non-vascular land plants, and fossils, has a single curator with limited re-assigned time and no collection manager or other staff. This configuration is especially typical of regional collections. Marshall University has a large Federal Work Study (FWS) population, which presents a mutually beneficial opportunity for both MUHW and students who need on-campus employment. Since 2014, MUHW has employed 20+ students (primarily FWS undergraduates) and our group has digitized 38,000+ specimens. Qualitative and quantitative data collected over the past three years demonstrate that undergraduates (in particular), including those with no botany expertise, can be extremely valuable partners in our efforts to mobilize specimen data. These students are eager for long-term job stability in the same way that curators need continuity in their workers. With proper training (including near-peer

7 **The Worldwide Engagement for Digitizing Biocollections (WeDigBio) event—A Global Stage for Your Herbarium**

Austin Mast, Florida State University, Department of Biological Science, Tallahassee, FL, 32306
Elizabeth Ellwood, Paul Kimberly, Paul Flemons, Kevin Love, Robert Guralnick

The annual Worldwide Engagement for Digitizing Biocollections (WeDigBio) Event engages thousands of citizen scientists to simultaneously advance the digitization of biodiversity collections and science literacy over four days. Volunteers contribute at onsite events (>30 in 2016) at museums, herbaria, science festivals, and science classrooms, as well as individually from remote locations, using online transcription platforms at DigiVol, Les Herbonautes, Notes from Nature, Smithsonian Institution's Transcription Center, and Symbiota. During the onsite events, participants learn about collections and biodiversity, interact with researchers, play games, and share experiences via social media, all while creating research-critical digital data. New for 2016, volunteers could interact with the WeDigBio logo (as used, e.g., for the temporary tattoos and stickers) using the Libraries of Life Augmented Reality Mobile App. The event's website, wedigbio.org, provides resources for curators planning onsite events in the months prior to WeDigBio, as well as a catalog of onsite events

and transcription projects from which participants can choose and a dashboard to show WeDigBio-wide progress over its four days. We invite you to participate in WeDigBio 2017 (likely scheduled for October). Please register your interest at wedigbio.org. The talk will present previously successful models for using WeDigBio for digitization and outreach by herbaria.

8 CollectionsEducation.org: Connecting Students to Citizen Science and Curated Collections

Erica Krimmel, Chicago Academy of Sciences
Debra Linton, Travis Marsico, Anna Monfils, Ashley Morris, Brad Ruhfel

College-level plant diversity courses often involve a collection project, which is designed to help students learn to correctly identify, document, and preserve specimens for scientific study. While these projects are invaluable teaching tools, the specimens and associated data are often not incorporated into herbaria or online biodiversity data aggregators due to lack of quality, herbarium backlog, or both. Furthermore, students are not exposed to the emerging online citizen science initiatives and herbarium databases of our information-rich digital age. Here we present a new project and associated website (http://collectionseducation.org), designed to enhance traditional collection projects, that can easily be incorporated into any course requiring a plant collection. The project integrates traditional taxonomic practices, ongoing citizen science initiatives, and digital-age curatorial skills, with the final goal of producing archival-quality, research-ready plant observations and collections that will become part of our national biodiversity archive. Due to the importance of collections in hand and online, this project emphasizes the skills and best practices required to facilitate downstream applications of student collections and documentation of plant biodiversity. Over the past two years, we have implemented this project in 11 courses taught at four American universities. We will present data from pre- and post-course student assessments, which provide an evaluation of the project's value not only to the biodiversity collections community, but to the students' learning.

9 SERNEC: Current efforts in a large-scale collaborative biodiversity project

Zack Murrell, Appalachian State University, Biology Department, Boone, North Carolina, 28608
Michael Denslow, Herrick Brown

SERNEC (SouthEast Regional Network of Expertise and Collections) was born out of ASB herbarium curator meetings in late 1990s and early 2000s. A 2001 symposium at ASB, The Future of Plant Collections in the Southeast, was a catalyst for multiple efforts that have had far-reaching ramifications. In 2004 the Society of Herbarium Curators was formed by ASB curators and SHC is now an international organization. In 2005 we obtained an NSF Research Coordination Network award to build the human infrastructure that began the " 2020 Vision" effort to digitize the region's herbaria. This effort engaged 150 herbaria in the region, training students, curators and professional botanists in museum informatics techniques. In 2014 we were awarded a NSF Advancing Digitization in Biological Collections collaborative project entitled The Key to the Cabinets: Building and Sustaining a Research Database for a Global Biodiversity Hotspot. This Thematic Collection Network (TCN) award involves 94 herbaria across the southeast and web/software based entities Symbiota, GEOLocate, Notes from Nature, Specify and iPlant/CyVerse that provide ourdata pipeline. Our curators are engaging students in museum curation, regional systematic and ecological studies, as well as service learning opportunities. The ultimate goal of the NSF TCN effort is to use the network to link the scientific expertise of the curators with their students, affiliate users, and the greater public

through the World Wide Web, to develop a citizen science framework to accomplish regional scale research goals. We have now imaged 2 million specimens, with 0.5 million transcribed and new data being added to our portal on a daily basis (sernecportal.org). Our data pipeline is totally functional, providing opportunities for engaging students, affiliates and citizen scientists in transcription and georeferencing efforts. We are currently engaged in ways to further energize our community to complete the transcription and georeferencing efforts.

10 National Science Foundation Funding Opportunities for Improved Collections Security and Digitization

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This presentation highlights funding opportunities at NSF for improvements in security, research use, and digitization of collections. The Collections in Support of Biological Research (CSBR) Program funds projects that seek to secure natural history and living stocks collections, including ownership transfer of orphaned collections. The Advances in Digitization of Biodiversity Collections (ADBC) Program funds collaborative digitization of specimens that are aggregated around specific research themes. NSF also funds research using collections and digitized collections data through the Postdoctoral Research Fellowships in Biology (PRFB) Program. Requirements and criteria specific to all funding tracks are outlined. Additionally, opportunities for broadening participation and building of human capital in collections-based activities are discussed.

11 The Use of Student Response Systems to Increase Student Engagement in Human Anatomy and Physiology Courses at Jacksonville State University

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New technologies, such as the Student Response Systems (SRS), help motivate students to be more prepared, maintain concentration in lectures, stay interested during class, and maintain response anonymity. SRS can increase understanding of complex human anatomy and physiology concepts and are becoming more common place in education. Human anatomy and physiology class was chosen because this class has huge volumes of material that students must learn and concepts that are sometimes difficult in understanding the physiology. The SRSs allows an entire class to respond to multiple choice questions displayed on a projection screen or TV. Students input their responses using remote devices, the results are instantly collected, summarized and presented to the class in visual format. These systems are used in lectures and as standalone quizzes. In attempt to increase student motivation for increased active learning, the clickers were incorporated to have a greater impact on the students overall grade. The purpose was to give the students a reason to study daily and weekly rather than just for major exams. A format with a Midterm and Final paper exams with all other points being collected from the Student Response System either in class or quizes was chosen. This was to increase the value of studying while helping the students succeed. The value of being in class, and listening to lectures was increased as points were available in all classes. This allowed the students to have greater control and immediate feedback on their grades. This created a lot of course preparatory work as well as data analysis on each question, and chapter for the class. There were positive and negatives to this approach however, in the interest in keeping students engaged, this system is very successful. Overall impacts on student learning outcomes still need more evaluation.

12 Differing Appearance of Starch Granules In Waxy and Starchy Potatoes

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James Sanders

Starch granules in fresh and processed foods are routinely identified by a variety of chemical and microscopic methods. In the teaching laboratory, the use of cross-polarized light in a microscope (monocular or binocular) quickly demonstrates the presence of starch granules by their characteristic birefringence, often called a Maltese cross. In the present study, we compared two common varieties of potatoes: waxy and starchy. Waxy (fingerlings, reds) and starchy (Russet) potatoes displayed differences in starch granule sizes and numbers. For example, distribution profiles from waxy potatoes showed mostly small starch granules whereas starchy potatoes (Russet) showed more large granules, but with a mix of small and intermediate granule sizes as well. In addition to demonstrating the birefringence of the granules, we used three overlapping chemical controls to confirm the presence of starch. First, Lugol's iodine solution, a starch indicator, immediately stained the granules. Second, amylase digested the starch granules within 30-40 minutes. Third, Benedict's solution demonstrated the presence of sugars that resulted from the enzymatic breakdown of starch granules by amylase. Although the demonstration of starch has long been a staple in teaching laboratories, we have combined the optical and chemical demonstrations of starch for the same lab, with each serving as a control for the other. Because the lab is flexible, teachers can add unknowns for a forensic twist. By using an ocular and stage micrometer or a hemocytometer, students in longer labs can collect and graph quantitative data of starch granule sizes and numbers. All materials and supplies are readily available at modest costs from grocery stores (potatoes), drug stores (Lugol's iodine), and educational supply companies (amylase, Benedict's solution, and polarizers).

13 Non-majors Biology Students' Environmental Knowledge and Perceptions About Conservation after Participating in Invasive Pest Plant Removal Projects

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Angelique Troelstrup, Penny Carroll

This study explored student knowledge and perceptions about the environment while enrolled in a non-majors biology experiential learning (EXL) course. To extend learning about conservation issues beyond the classroom walls, students participated in invasive pest plant removal projects on public lands. To learn more about the impact of the ecological restoration component of the course the following research question was posed: What are student perceptions of the importance of civic engagement as it relates to the environment and more specifically, the conservation work in which they were involved? Physical removal of invasive pest plants is one management strategy that produces sustained, immediately observable, and positive results. The student's restoration efforts were in locations that students can return to year after year to see the impact of their work. Project work sites were located on historically relevant civil war sites and partnering agencies included the National Park Service (Stones River National Battlefield) and the Murfreesboro parks department. Students worked in small randomly assigned collaborative teams for four to six hours based upon the dates and work site. Training was provided in class and on site by park staff. Explanations included the significance of the work and the value, environmentally and fiscally. Students were initially unsure of the restoration work associated with experiential learning project and had different expectations but most reported they ultimately valued it. One student stated this project gave them their first experience using a shovel and

another said they had very little experience being outside. The most impressive aspect reported by students was seeing the physical progress of their work. A high percentage indicated the project had value as a conservation effort and should be continued as a requirement of the course.

14 Using HHMI Resources to Maximize Biology Instruction
Brenda Royal, John Overton High School, Nashville, TN, 37220

The Howard Hughes Medical Institute Biointeractive is a web-based compendium of data driven lessons which address the standards of biology from middle school through college. Most lessons can be structured around a 10-15 minute video which hooks students into the concepts which are then covered in lesson plans that include data analysis and/or graphing, dry labs, interactive labs, video review sheets, and a variety of resources. Teachers guides for various areas of biology link the resources to NGSS, IB, and AP standards. These free resources provide teachers with new ways to teach curriculum as well as updates to existing textbooks.

15 Teaching Genetics in the Age of Personal Genomics
Steve Coggin, Catawba College, Biology, Salisbury, NC, 28144

Personal genomics offers people an opportunity to explore their genetic legacy and many of the techniques involved are covered in undergraduate genetics classes. The rapidly decreasing cost of genome analysis has opened numerous ways for the general public to explore their genetic information and understand themselves. One type of analysis is to examine several hundred thousand SNPs to evaluate ancestry, carrier status for genetic disorders and phenotypic traits. Another is whole exome sequencing to explore all the protein coding genes. The ultimate level of genetic analysis is whole genome sequencing. Even dogs have can have their genomes analyzed. In my genetics classes I have the students learn the techniques used in these analyses including gene chips, Sanger sequencing and next-gen sequencing. I had my own genome analyzed by the company 23andme and use this information for class discussion and student exercises. My students use the 23andme reports to explore classic genetic traits like hair color, eye color, widow's peak and ear lobe attachment. One of the most interesting reports is on ancestry including geographic origins and Neanderthal makeup. The Neanderthal information is used to discuss ancient DNA and human evolution. 23andme also gives access to the raw genetic data as Excel or text files. These files contain the base composition of over 600,000 positions in the genome. With this information it is possible to hack your own genome and get information that goes beyond the 23andme reports. My genetics students use SNPs from my data to explore traits and health aspects with analysis tools like SNPepedia and Promethease. The lives of our students are being transformed by the genomic revolution. The discussions and activities mentioned here give the students insight into new tools and new knowledge.

16 SEA-PHAGES (Science Education Alliance-Phage Hunters Advancing Genomics and Evolutionary Science): Implementing a freshman undergraduate research course at a public comprehensive university
Victoria Frost, Winthrop University, Biology, Rock Hill, South Carolina, 29733
Kristi Westover

Undergraduate research is a vital part of required student training, but it can be difficult to implement at primarily teaching institutions where faculty time and finances are more limited. Winthrop University successfully applied to be part of SEA-PHAGES, an inquiry based research course developed by the Howard Hughes

Medical Institute's Science Education Alliance that aims to introduce undergraduate students to genuine hands-on research in their first year of higher education. We are now part of a global team, searching for novel bacteriophages. We used a two-semester model so that students participated in two research courses in their first year as an undergraduate. During the first course, students used microbiological and molecular techniques to successfully replicate and isolate their own novel phage in the host bacteria *Mycobacterium smegmatis*. Between semesters, the SEA-PHAGES team (under the direction of Dr. Graham Hatfull at the University of Pittsburgh) sequenced two phage genomes. During the spring semester, students used bioinformatics computer programs to annotate the genomes belonging to phages Asriel and HaiMas. The culmination of the students work will be participation in local scientific meetings, collaborating and sharing knowledge with a national network of scientists and the opportunity to present their results at the annual HHMI SEA-PHAGES symposium. Feedback from this first group of students has been very positive and encouraging. A number of the students wrote in their evaluations that the course had allowed them "to experience a new side of biology that I had not before considered," "helped me realize my love of biology in a research based field" and "I am now considering a future career in the field of research." The SEA-PHAGES framework allowed WU to overcome some of the challenges mentioned and provide research training to entry-level freshmen.

17 An alternative grading strategy to more accurately reflect student learning

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Ideally, grades provide meaningful formative and summative assessments of student learning. However, faculty and students often have trouble articulating the specific value of course grades. Does a C student know 75% of the course material really well, or does the student know 100% of the course material to only an adequate level? Did the A student, despite completing all of the assignments, fail to grasp several fundamental concepts of the course, while the B+ student understood the fundamentals, but did not turn in a couple of homework assignments? These examples illustrate just a few limitations in our ability to give students meaningful feedback. Recent efforts to encourage faculty to clearly define their expectations for student learning have led to more thoughtful course design and pedagogical strategies, including defining student learning objectives. Using the American Society of Microbiology's (ASM) core learning outcomes as a guide, a standards-based grading system was implemented in an attempt to better connect student learning objectives to course grades. Each exam question or assignment is assigned to a specific learning objective and students are graded on their level of mastery of that objective instead of successfully answering a certain percentage of questions or assigned points. As such, students receive formative feedback not only as a letter grade, but as an evaluation of their current understanding of the material. Ultimately, the goal is for the instructor and the student to have more accurate evidence of student achievement in the course.

18 Metacognition in college students: what is it and why should faculty care about it?

Chris Barton, Belmont University, Department of Biology, Nashville, TN, 37212

There are a growing number of studies and published literature focusing on the concept of metacognition. In short, metacognition is often described as the ability of an individual to assess their own skills, knowledge, and learning. In the past few years, I have found that there are a significant number of students who seem to lack a true sense of metacognition. These students typically believe they have very effective study habits, can learn course material fairly quickly, and only need to

study for short periods of time in order to be successful. Due to their lack of metacognition, many of these students will actually stop studying before they fully learn the material needed for them to succeed and, as a result, perform poorly in their courses. The goals of this presentation are three-fold: i) to present data from my courses that helped me to identify students lacking in metacognition, ii) discuss the challenges that I faced in trying to help these students succeed in my courses, and iii) spark a discussion with faculty to share interesting methodologies used to help students gain successful study habits.

19 A reflection of the efforts to transform the culture of learning into a more student-centered, student-engaging focus: I had a vision, I made changes, I assessed the outcomes, and now I am adapting accordingly

Valarie Burnett, Newberry College, Science and Mathematics - Biology, Newberry, SC, 29108

Based on innovative teaching initiatives called for in Vision and Change in Undergraduate Education: A call to Action, released by the American Association for the Advancement of Science in 2011, I gradually incorporated student-centered instructional methods into my courses over the past five years. Each term, I added new assignments and activities designed to promote student engagement, inquiry, critical thinking, communication, meta-cognition and hopefully inspire lifelong learning. Student-centered strategies were mainly utilized in a two-semester sequence of Anatomy and Physiology and included problem-solving exercises and case studies, playing various concept-related games, engaging in literature research and student-led instruction, and conducting simple primary research. Over time, corresponding test scores increased with the introduction of certain activities. At the end of each term, students were asked to evaluate the usefulness of these assignments based on appropriate criteria related to the goals mentioned above. Most students felt these assignments were extremely useful in these areas. However, as more labor-intensive assignments were added each term, an increasing number of students reported being overwhelmed by the workload. In addition, the incidence of plagiarism increased, while the quality of research reports and presentations decreased last year in the first course, compared to previous years. However, students showed improvement in these areas in the second course. It is unclear whether the recent increase in demands may have contributed to the plagiarism and poor quality of student work. To address the concerns expressed by students regarding the workload, and to provide time to produce quality work, the four research assignments were divided between the two courses this year, such that each course now includes two of the assignments. Based on student perceptions, this change appears to have made the course more manageable, and there has been a reduction in plagiarism and an improvement in the quality of work.

20 Detection and Characterization of Biosurfactants Produced by the *Kistimonas* Species

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Michelle Suhan-Thomas

Biosurfactants are a broad category of amphiphilic detergents that are produced by biological organisms and are increasingly being investigated for potential uses in bioremediation efforts. Biosurfactants function to lower the surface tension between two immiscible liquids and increase the solubility of nonpolar compounds in aqueous solutions. The genus *Kistimonas* is comprised of two species, *Kistimonas asteriae* and *Kistimonas scapharcae*, which were isolated from marine invertebrates in the Korean coastal waters. A proposed third *Kistimonas*

species, *Kistimonas allitiae*, has been isolated from *Alitta succinea* and shows resistance to anionic surfactants such as cetyltrimethylammonium bromide (CTAB). Current research is focused on determining if these surfactant resistant species produce biosurfactants using three methods: blood agar hemolysis, drop collapse, and oil spreading. In the blood agar hemolysis method, partial or complete hemolysis after 72 hours at 23°C indicated indirect evidence for biosurfactant production. The drop collapse method provided qualitative measurements of biosurfactant production by measuring the extent of collapse of liquid culture on an oil coated surface. The oil spreading technique measured the clear zone of displaced oil by liquid culture and was the most sensitive of the three methods. *Kistimonas asteriae* and *Kistimonas scapharcae* show low levels of biosurfactant production. Identified biosurfactants will be isolated through solvent extraction and characterized using thin layer chromatography.

21 Diversity of *Escherichia coli* found in sand of South Carolina beaches

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Douglas E Johnson, Cameron Sellers, Victoria J Frost, Matthew J Heard

Escherichia coli (*E. coli*) is a common bacterial species that can persist in many different environments including the oceanic beach. This environment is of particular concern because *E. coli* can be an indicator of both fecal and microbial pollution. While the majority of strains of *E. coli* are not pathogenic to humans, certain phylo-groups are associated with virulent strains that could cause disease. Therefore, it is of critical concern that we determine where the *E. coli* that is found in the oceanic beach environment is coming from, and whether or not it could be potentially harmful to humans. In this study, we used multiplex PCR to identify which phylo-groups the isolates of *E. coli* belong. This phylo-group classification can help infer the source of pollution. For our analysis, we collected sand samples from South Carolina beaches. We identified environmental isolates of *E. coli* that differ from the laboratory strain and belong to a few distinct phylo-groups including phylo-group A, likely from human fecal contamination, and phylo-group B, which is likely from a domesticated or wild animal source. Our findings conclude that multiple types of *E. coli* can be detected in these environments and further research is needed to determine whether or not these strains are a public health concern.

22 The Effects of Coastal Renourishment on the Presence of *Escherichia coli*

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Oceanic beaches are dynamic ecosystems that are constantly changing. One of the main sources of change on oceanic beaches is erosion resulting from winter storms and hurricanes. That erosion is routinely combated by renourishment projects. During renourishment, sand is dredged from offsite locations and placed on the beach in the eroded areas in an effort to replace lost surface area. Recent studies have shown that both erosion and renourishment can affect the microbial species found on the beach. One important microbial species that is of concern on oceanic beaches is *Escherichia coli*, which can be an indicator of pollution and other pathogens. In this study, we examined how the process of renourishment affected the abundance and distribution of *E.coli* on an oceanic beach in South Carolina. To do this, we collected sand samples from three sections of the beach (i.e. dunes, intertidal, sub-tidal) at 30 sites over a two-year period and examined how *E.coli* varied spatially in presence and abundance across the beach. Using this approach, we determined that *E.coli* was present in all locations across the beach, but was significantly influenced by renourishment. More specifically, we determined that there were significantly higher levels of *E.coli* in the intertidal zone of the beach,

which is where renourishment takes place. In addition, we evaluated the properties of sand grains in order to correlate trends between *E.coli* abundance and grain properties. We also determined that the effects of renourishment were reduced over time, but not entirely diminished. Collectively, our findings indicate that renourishment has an effect on the abundance and distribution of *E.coli* but, more work is needed to fully understand this process.

23 A Novel Description of Microbial Population Diversity in the Intestinal Lymphatic Fluid Chyle

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Rune Toms, MD, Michael Sandel

Microorganisms have played an important role in the evolution of the immune systems and intestines of mammals. This coevolutionary role of the intestinal bacterial microbiome is of broad research interest as it relates to normal intestinal function and disease. Bacteria and bacteriophages are omnipresent in our environment, and bacteriophages are found in abundance wherever bacteria are present. Chyle samples were obtained via sterile technique from patients with diagnosed postoperative chylothorax or congenital chylothorax, and a microbiome analysis was performed via next generation sequencing and analysis by QIIME package for microbial population analysis. Microbiome output data were notably consistent among a majority of pre-fed infants revealing a consistent and unique population of bacteria and associated bacteriophages in chylus fluid.

24 Determination of DNA Extraction Protocol Impacts on Detection of *Wolbachia* in Insects.

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Wolbachia, a common bacterial endosymbiont in insects, has attracted significant research attention due, in part, to its potential to inhibit mosquito vectors from transmitting human pathogens. Beginning in Fall of 2013, Principles of Biology I Laboratory students at Armstrong State University, as part of a semester-long experiment, used molecular techniques to test for the presence of *Wolbachia* in locally-collected insects. In order to reduce the cost associated with this course, Armstrong transitioned from using a commercially-produced DNA extraction kit to using 'homemade' solutions. Subsequently, the observed prevalence of *Wolbachia*-infected insects declined from an average of 23.75% to 16.51%. Since success of PCR at detecting a gene target depends on having DNA extracts of sufficient concentration and quality, we hypothesized that the decrease in observed infections was more likely due to the change in the DNA extraction protocol rather than a change in the insect/symbiont community. To test this hypothesis, 31 cockroaches were collected and halved; from one half, DNA was extracted using the commercial kit solutions. From the other half, DNA was harvested using 'homemade' solutions. DNA samples were then subject to PCR amplification of the *Wolbachia* 16S rRNA gene and the insect CO1 mitochondrial gene. Amplicons were detected using gel electrophoresis. In order to mimic the classroom exercise, a standard volume of genomic DNA was added to the PCRs regardless of concentration differences. *Wolbachia*detection among the cockroach sample set was 48.4% (commercial kit DNA samples) versus 19.4% (DNA samples generated using homemade solutions). DNA extracts produced from homemade reagents had lower DNA concentrations, suggesting that the change in protocol contributed to the reduced detection rates of *Wolbachia*. Results from this work have implications for

research and classroom-based exercises that use PCR to screen plant or animal samples for the presence of specific endosymbionts.

25 Fish gut micro biomes: action and reaction

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Gastrointestinal microbiota play an essential role in maintaining the health of the host. Externally induced changes to these mutualistic communities can affect the host in diverse ways, including altering the digestibility of food sources. Fish living in water with anthropogenic pollution may thus be doubly impacted by the poor water quality. Any subsequent diet changes would amplify the disturbance to the ecosystem. Two species of fish living in three different streams with a range of water qualities were evaluated. Gastrointestinal microbial communities were assessed through DNA sequencing and functional gene expression assays. As expected, relative proportions of different bacterial groups by individual. However, trends were seen when the data was analyzed by comparing species. Additionally, certain water quality indicators may influence the community structure as well. These preliminary results suggest that water quality could ultimately impact not only individual species but also the trophic structure of the ecosystem as a whole.

26 Identification of a Toxin Producing Unknown Bacterial Species Isolated from an Urban Pond

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Alfredo Leon

In an attempt to survey the bacterial population in local man-made water sources, a sample was taken from the pond located in Miami Dade College North Campus' Palmetum. When it was cultured, a colony was observed that had a cleared zone of inhibition. This particular colony was isolated in order to identify the species and understand what toxic properties it exhibits that prevented the other bacterium in the pond from growing around it. In order to ensure that only one species was present, isolation cultures were inoculated and observed at the microscopic level over a week's time. Furthermore, a dichotomous key was developed that incorporated both morphological traits and differential biochemical tests to categorize the unknown species. Additional tests were performed alongside the differential tests of the dichotomous key to accurately classify the microorganism. It was determined that the bacteria is a gram-positive, aerobic, motile, spore-producing, rod shaped member of the Bacillus genus. Three particular species, *Bacillus sphaericus*, *Bacillus pasteurii*, and *Bacillus laterosporus*, correspond to multiple properties of the unknown. Identification is to be confirmed with some further testing and genomic DNA sequencing. Experiments to recreate the toxicity exhibited in the pond will be developed upon species verification.

27 Degradation of aromatic dyes by bacteria isolated from soils previously exposed to aromatic compounds and by common lab bacterial cultures

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Henry Spratt

Increased industrial and textile use of synthetic dyes has caused contamination of numerous water sources. This study focuses on the degradation of two dyes, malachite green and amaranth dye by bacteria cultures. Two of the cultures used

here were isolated from soil that had previously been exposed to organic aromatic compounds (e.g., pesticides). The previous exposure to aromatic compounds is expected to have enhanced these strains' dye degradation capabilities. These cultures were identified as *Bacillus mycoides* and *Bacillus sp.* Microbiology laboratory strains used included *Pseudomonas aeruginosa* and *B. subtilis.* Pure cultures of the different bacteria were used to inoculate sterile dilute tryptic soy broth media in replicated microcosms. Experiments were initiated by the addition of dyes to separate microcosms and ran for approximately two weeks. Analysis of dye remaining in the microcosms was done in time course fashion by periodically, removing 1 ml of the microcosm solution. This solution was centrifuged for 2 minutes at 13,000 rpm to remove cells, with the supernatant transferred to a 1 cm cuvette, using a spectrophotometer to obtain absorbance readings. Concentrations of dyes in the microcosms were determined using a linear regression based on standard calibration curves. This data was used to calculate percent of degradation for each of the cultures. All bacteria strains in study exhibited some degree of dye degradation. *P. aeruginosa* degraded both malachite green and amaranth to the greatest extend (83.2% vs. 97.4%, respectively). *B. subtilis* degraded 49.6% of the malachite green. Amaranth was not substantially degraded by any cultures other than the *P. aeruginosa.* Bacteria isolated from soils exposed to aromatic organic matter degraded these dyes no faster than the lab cultures. These results suggest that pure cultures of bacteria have the potential to aid in bioremediation of water contaminated by synthetic dyes.

28 Bacterial contamination in the environment of neonatal and pediatric intensive care units

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David Levine, David Giles, Mark Rowin, Janara Huff

Concern for health care acquired infections (HAIs) has increased in recent years. Recognized routes of patient infection have included patient to patient or staff contact, and contamination from the clinical environment. In this study we compared environmental bacterial contamination in the neonatal and pediatric intensive care units (NICU & PICU) in a public hospital in Chattanooga, TN. Using data from a previous study in the NICU we established the 10 most likely contaminated sites, and sampled these in both the NICU and PICU. Those 10 sites were sampled (with triplicate replication) using sterile transport swabs. Swabs were placed on ice and returned to a microbiology lab, where they were use to inoculate Mannitol Salt Agar (for Staphylococci), CHROMagar MRSA (for methicillin resistant *S. aureus*), Pseudomonas Isolation Agar (for *Pseudomonas sp.*), Eosin Methylene Blue (for enteric bacteria), and Tryptic Soy Agar (for non-specific bacteria). Of the 29 swabs collected in the NICU, 18 (62.1%) were positive for some type of bacterial growth. For the PICU 23 out of 34 (67.6%) swabs were positive for growth. *S. aureus* or MRSA was found on 7 of 29 (24.1%) swabs in the NICU, and 12 of 34 (35.3%) swabs in the PICU. Overall, 6 of 63 swabs total were positive for MRSA. The most contaminated areas in either the NICU or PICU were the floors near the sink, and the return air ducts. Another sampling, linked with a full "terminal cleaning" of the areas sampled occurred in the PICU. Swabs were collected just prior to the cleaning and then again two days after the cleaning. Overall contamination was somewhat reduced, however there was no significant difference in contamination before and after the cleaning. Measures to help enhance the cleaning procedures in the NICU and PICU at this hospital have been proposed.

29 Evaluation of Antibacterial Activity of Microbial Isolates from Soil

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Development of antibiotic resistance by pathogenic microorganisms is increasing. Reasons that account for antibiotic resistance by microorganisms include genes for enzymes that inactivate antibiotics, ejection of the antibiotic by plasma membrane proteins, and mutations affecting mode of action of the antibiotic. This research attempts to isolate soil microbes producing strong antibacterial activity on various microorganisms especially *Staphylococcus*. Soil samples were collected from Prattville, AL, North-Montgomery, AL, and around the AUM campus in Montgomery, AL. Three random soil samples were collected from each area and pooled to together. Nineteen tentative antibiotic producing isolates were purified by streaking on tryptic soy agar plates. After two screening steps, four isolates, N-1, P-2, P-12, P-13, were selected for further studies. Isolate P13 significantly inhibited *Staphylococcus aureus*, *S. epidermidis*, *Citrobacter freundii*, and *Alcaligenes faecalis* and was selected for further studies. Ribosomal RNA gene sequence analysis was employed to characterize the selected isolates.

30 Techniques to Examine Insect Haustellate Mouthparts

Alison M. Arling, Clemson University, Plant and Environmental Sciences, Clemson, South Carolina, 29634 Suellen Pometto, Charles E. Beard, Peter H. Adler, Konstantin G. Kornev

Lepidopteran proboscises are composed of tough cuticle surrounding soft tissue. The proboscis can be separated into its two component halves (galea), which are normally held together by legulae. We have shown that the organism can repair a separated proboscis, contrary to previous claims. To confirm repair, we needed to examine the status of the connecting legulae and internal structures. The tough cuticle and soft internal structures present challenges; traditional histological techniques did not produce usable tissue sections. Fixatives such as ethanol or formalin did not adequately fix soft tissue and hard cuticle. We found that Bouin's fixative gave the best preservation of soft tissue without undo hardening of the cuticle. Paraffin did not support the tough cuticle to allow cutting; instead the tissues tore the paraffin. Therefore, we used LR White acrylic resin for embedding and sectioning. We found that metal knives minimized shattering and striations compared to glass, sapphire, and disposable metal blades, and that a thickness of 3-5 µm was best. The optimal sections allowed us to visually confirm that the ventral legulae had reconnected in the repaired proboscises. Currently, we are using these techniques to compare the proboscis of fluid-feeding Diptera with that of Lepidoptera. The information provided by our microscopic sections contributes to biological information used by materials engineers for bio-inspired microfiber development.

31 What the butterfly proboscis has been hiding

Charles E. Beard, Clemson University, Plant and Environmental Sciences, Clemson, South Carolina, 29634 Peter H. Adler, Konstantin G. Kornev

The butterfly proboscis is generally viewed as a drinking straw, that is, a sealed tube with an opening at the distal end through which fluids are acquired. However, it is more complicated than a simple drinking-straw model. When butterflies such as the monarch drink, the tip of the proboscis is turned back on itself as in a "J". How does the butterfly drink if the tip is not in the fluid? This paradox created an interest in

engineers for bio-inspired materials. We found that the proboscis is not a sealed tube, but is porous along its length. Drinking relies on multiple actions of capillarity, hydrophobicity, and suction. The parts of the proboscis that take up fluids are hydrophilic, whereas the exterior of the proboscis is hydrophobic. Why would a fluid-feeding organ have a hydrophobic surface? The surface needs to remain clean if it is to function, and hydrophobicity allows self-cleaning. The hydrophilic areas are arranged to channel fluids into the food canal so they can be transported to the gut. The shape of the proboscis reflects the preferred feeding substrate of the butterfly. Proboscises that are round in cross section generally are associated with nectar feeders, whereas elliptical proboscises are associated with sap feeders. Natural selection has modified the proboscis of butterflies and moths in numerous ways associated with diversification of species, but with common themes of biological technology.

32 A survey of freshwater snails and their parasites in Alabama.

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Alabama is known as a global hotspot for freshwater gastropod diversity. Interestingly, many snails serve as obligate hosts to trematode flatworms (Platyhelminthes: Trematoda) that use these snails as the primary intermediate host for larval production. As a single species of snail can serve as a host to multiple parasite species, a phenomenal amount of diversity of trematode parasites in Alabama is likely. Unfortunately, the identification of trematode worms is exceptionally difficult due to insufficient availability of keys and lack of taxonomic experts to identify these unknown or understudied parasites. Thus, the use of molecular markers to identify worms and their relationships with snail hosts is the most logical way to proceed when addressing the biodiversity of this group. DNA was extracted from trematodes collected from Prosobranch (gilled) snails including: *Pleurocera striata*, *P. pyrenell*,* P. excurata*,*Elimia carinifera*, *E. carinocostata*, *Viviparus Georgiana*, *V. subpurpurea* and Pulmonate (lung) snails including: *Physella sp*. , *Planorbella trivolvus*, and *Pseudosuccinea sp.* Using sequenced 18s rDNA, a GenBank BLAST search was used to match trematodes collected in our samples against published sequences, we identified 15 trematode families with percent sequence matches ranging from 95 to 99 percent. Trematodes in the families: Collyriclidae, Cyathocotylidae, Fasciolidae, Haematoloechidae, Heterophyiidae, Lecithodendriidae, Macroderoididae, Opisthorchiidae, and Pronocephalidae were found in Prosobranch snails while Cephalogonimidae, Diplostomatidae, Echinostomatidae, Gastrothylacidae, Spirochiidae, and Telorchiidae worms were found in Pulmonate snails. Although BLAST results did yield genus level matches, further phylogenetic analyses including 18s rDNA and ITS2 molecular markers are necessary to validate the accuracy of these identifications for trematodes collected in Alabama. It is very likely that undescribed trematode taxa will be revealed in these efforts establishing the need for more broad scale collection efforts to describe the diversity of this poorly understood fauna.

33 Kinorhynch assemblages in the northern Gulf of Mexico continental shelf

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Kinorhynch assemblages were studied from multiple locations on the continental shelf in the Gulf of Mexico. Sediment was collected from 37 stations in Fall 2013 and Fall 2014, on NOAA ships *Pisces* and *Gordon Gunter*, using a multicorer.

Collection locations on the shelf varied in depth from 36-187 m. The sediment was fixed on the ship in formalin, and the animals were later isolated from the sediment using centrifugation and identified by light microscopy or scanning electron microscopy. A total of 812 animals were identified to >30 species, many of which are new to science. The data was analyzed with Primer 6 ® software. Cluster analysis revealed two main groups of collection sites, those close to the outflow of the Mississippi River and those removed from the outflow. The most abundant species were *Echinoderes bookhouti*, *E. skipperae*, *E. augustae*, and *E. spinifurca*, which were more abundant near the Mississippi River and comprised 80% of the 812 identified animals.

34 Stayin' Alive: Evidence for Learning in Aphids

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The ability of animals to learn is often demonstrated through classical conditioning. Classical conditioning is a process that involves repeatedly pairing two stimuli. A response that is, at first, elicited by the second stimulus is eventually elicited by the first stimulus alone. In this study, we examined whether pea aphids, Acyrthosiphon pisum, could associate a novel stimulus with increased predation risk, through classical conditioning. Aphid colonies demonstrated a clear ability to learn and associate a light stimulus with alarm pheromone production. This study demonstrates, for the first time, classical conditioning in aphids.

35 Invasive species alter parasite communities in the southeastern US

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Introduced species are a threat to biodiversity and human health in ecosystems around the world. Two reasons for this are that they can introduce novel diseases and that they can alter parasite dynamics in invaded communities. While research on these topics has increased over the past few decades there are many geographic regions where we do not have a clear understanding of how invasive species are altering disease dynamics. In this study, I examined how the introduction of invasive animals to Alabama, Florida, Georgia, Kentucky, Mississippi, North Carolina, South Carolina, and Tennessee has altered helminth communities. To do this, I downloaded records of the 70 chordates that are classified as invasive species in the eight states described above from the Invasive Species Specialist Group database. Using these records, I then searched the Host-Parasite Database to determine what helminth species have been documented for each of these 70 hosts in their invaded range. Using these search parameters, I found 8 of the 70 species had relevant data, which suggests we currently have limited information on how invasive species are altering helminth communities in this region. For the 8 species with helminth records, I then examined the records to determine how often hosts introduced new helminths, picked up helminths from invaded communities, and carried zoonoses. Interestingly, I found no records of introductions of helminths by invasive animals, which suggests that these invaders may primarily act as amplification hosts. I also determined that 4 of the 8 animals were hosts to zoonotic helminths, which could indicate that invasive animals may increase the likelihood of spillover events. Collectively, these findings indicate that invasive species can alter disease dynamics in native communities, but that we are lacking data to accurately assess this issue.

36 The Effects of Background and Illumination on the Foraging Behavior of Naïve Manduca sexta Hawkmoths

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This study explores the foraging behavior of the *Manduca sexta* hawkmoth, a crepuscular/nocturnal moth, which feeds on nectar with its long proboscis while hovering in front of flowers. Similar to most other insect pollinators, *M. sexta* relies heavily upon both vision and olfaction to discover its feeding source. Depending on the amount of light present in the environment (illuminance), *M. sexta* may use achromatic and/or chromatic vision to evaluate potential nectar sources. Under low light conditions, chromatic vision may not be possible for *M. sexta* due to physiological constraints. In dual choice experiments using a white and a dark blue feeder against a light background (plain white), naÃ¯ve *M. sexta* showed a bias toward the blue feeder under illuminances corresponding to twilight conditions. In a similar set of experiments, but using a dark background (dark green) naÃ¯ve moths showed a bias toward the white feeder under dim illuminations (starlight and crescent moonlight illuminances). These apparent contradictory behaviors warrant further investigation. Thus, here we set to investigate the effect that background and illuminance have on the use of achromatic or chromatic vision in the floral choices of M. sexta. We performed a dual choice experiment with dark blue and white artificial feeders under three different illuminances (starlight, quarter-moonlight, and twilight) in either white or dark-green experimental cages. Results suggest naÃ¯ve moths-regardless of background-use achromatic signals in starlight conditions, but switch to chromatic vision under brighter, twilight illuminances. Interestingly, under the intermediate, quarter-moon illuminance, moth's choices were strongly affected by background coloration. In our discussion, we consider the putative ecological significance of this flexible use of visual information in *M. sexta*, a hawkmoth that actively forages in nature under a range of illuminances that span five orders of magnitude.

37 Climate Change and the Effect of Temperature on the Release of *Proterometra macrostoma* (Trematoda: Digenea) Cercariae from their Snail Intermediate Host, *Pleurocera semicarinata* (Gastropoda: Pleuroceridae).

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Favour Akabogu, Sandra Meneses, Olivia Slater, Aubrey Melton, Casey Tetidrick, Sarah Blank, Ron Rosen

Digenetic trematodes are potentially susceptible to changes in temperature during the free-living stages of their life cycles and as internal parasites within their ectothermic molluscan hosts. Even small increases in temperature associated with climate change could increase the proliferation of their infective stages. The objectives of this study were to assess the effect of temperature on the release of the *Proterometra macrostoma* cercaria from its snail intermediate host, *Pleurocera semicarinata*, determine Q10 temperature values, the METT (minimum emergence temperature threshold) and the MDTT (minimum development temperature threshold). There was a steady increase in cercarial emergence up to 25° C, after which cercarial release leveled off. The METT was determined to be at approximately 13° C and the MDTT between 10-12°. These values are intermediate between cercarial emergence patterns summarized for digeneans that are low latitude (≤ 35°) and mid-latitude (36-60°) species. Q10 values calculated at 10° C increments were greatest at the lowest temperature interval followed by a steady decline at the two higher temperature intervals. In the future it is possible that the

optimal range for *P. macrostoma* cercarial release will extend into the late fall and early winter resulting in year round infections of its centrarchid fish definitive hosts.

38 Examination of the relative abundance, species richness and diversity of mosquitoes on the campus of Berea College during the mosquito season of 2016.

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Mosquitoes are known to vector human pathogens that kill three quarters of a million people each year worldwide. There is limited literature regarding species richness and diversity of Kentucky mosquitoes. The goal of this project was to determine the relative abundance, species richness and diversity of mosquitoes on the campus of Berea College located in southern Madison County, KY. Three different trap types (CDC mini-light trap, BG Sentinel trap and a Gravid trap) using octanol, skin extract and CO2 as attractants were used to collect mosquitoes at four sites on Berea College's campus each week over 21 weeks (June 15 - November 4, 2016). Traps were set between 1600 - 1800 each afternoon and retrieved between 0800 - 1000 the next morning. A total of 3,994 mosquitoes were collected representing six genera and 20 species. The five most abundant species included *Culex pipiens* (21.9%), followed by *Aedes albopictus* (18.9%), *Aedes vexans* (17.9%), *Culex salinarius* (14.9%), and *Psorophora columbiae* (7.3%). *Aedes albopictus* and *Culex pipiens* comprised 74% of all mosquitoes collected at Sites 1 and 4 where there was the most human traffic. The greatest number of mosquitoes was collected from the compost area (Site 2; n = 1,275) which also yielded the greatest species richness (18 species). Species diversity, as determined by the Shannon-Weiner Index, was found to be the greatest at the College farm (Site 3; H = 1.50) and at the residential site (Site 4; H = 1.50), while the least species diversity was found to be at a small wooded site adjacent to the Hall Science Building (Site 1; H = 1.15). *Aedes aurifer*, a species not previously found further south than southern Ohio, was identified for the first time in Kentucky at two of the collection sites.

39 Convergent evolution of fluid uptake mechanisms in insects when feeding from porous substrates

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Fluid-feeding insects, such as butterflies and moths (Lepidoptera) and flies (Diptera) (together 20% of all animal species), face a common selection pressure of having to remove and feed on trace amounts of fluids. Insects able to feed from liquids trapped in pores would have increased fitness and an advantage over other individuals under drought conditions. We hypothesized that flies and butterflies have developed a common mechanism for fluid uptake from porous surfaces. We performed feeding trials where insects were fed solutions containing magnetic nanoparticles from filter papers of various pore sizes to demonstrate feeding patterns of butterflies and flies. Our results indicated that flies and butterflies both employ capillary action for fluid uptake from porous surfaces. In addition, we revealed a pattern of limiting pore sizes from which insects could feed that is related to mouthpart conduit sizes - insects with mouthpart diameters larger than the diameter of the pores were not able to successfully acquire fluids for uptake. The limiting pore size for flies was related to the diameters of the pseudotracheae rather than the food canal, providing the first evidence that capillary action first occurs in

these conduits. Given that natural selection independently favored mouthpart architectures that support fluid uptake via capillarity (Diptera and Lepidoptera share a common ancestor with chewing mouthparts 280 mya), we suggest that the convergence of this mechanism advocates this as an optimal strategy for obtaining trace amounts of fluids from porous surfaces.

40 Overview of an aquatic micro-ecosystem at Blount Springs, Blount County, AL

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David Frings

We have begun characterizing the macro- and microbiota of the water effluent from spring heads at Blount Springs, Blount County, AL. Water chemistry measurement were taken from spring heads. DNA was isolated from water samples, bacterial matts. and visible macroinvertebrates. Prokaryotic 16S rDNA, eukaryotic 18S rDNA, or mitochondrial COI DNA fragments were PCR amplified, TOPO-TA cloned, and colony sequenced to determine the organisms present. The preliminary results indicate a diverse and possibly unique community including one unique colonial annelid thriving in the extremophile sulfur environment.

41 Extremophile Association with Geologic Setting in Sulfur Springs at Blount Springs, Alabama

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David Johnson

The geologic setting of the springs located at Blount Springs, Alabama creates an extreme environment that supports a variety of unique bacterial matts, and marcoinvertebrates such as annelida and planariidae . These extremophiles appear to rely on the sulfur that is produced from the iron pyrite (FeS2) found in the Chattanooga Shale which forms a confining layer for the underlying limestone aquifer. The window located in the southwestern end of the Sequatchie anticline exposes limestone of the Red Mountain Formation which forms the aquifer that supplies the mineral rich water from a series of four springs, supporting a unique community of extremophiles.

42 Oyster Restoration Utilizing Artificial Substrates: Implications for Mitigating Oyster Decline in the Chesapeake Bay

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The high national priority of developing artificial oyster reef substrates is a consequence of scarcity and consequential expense of natural oyster shells available for restoration. Restoration is imperative because the historical abundance of native oyster populations has declined 99% over the past 100 years. A common artificial reef substrate is concrete made with silica sand. However, conventional concrete results in reduced long-term oyster survival and increased competition with other organisms like barnacles. The aim of this research is to test alternative concrete formulations in oyster restoration efforts. Specifically, we field-tested the statistical hypothesis that wild juvenile oysters would strike to and grow on concrete casts of oyster shells made with limestone sand as often as striking to casts made of concrete with silica sand. Limestone sand has elevated levels of calcium, which is known to attract oyster larvae for settlement and growth. Natural oyster shells were used as a control and reference substrate. An initial Kruskal-Wallis post hoc test

suggests that after one spawning and recruitment period (14 weeks, 2016), shell casts made with limestone sand attracted similar abundances (149, n=80, median=1, Q1=0, Q3=2) of oyster spat as normal concrete casts (174, n=80, median=1.5, Q1=1, Q3=3; $p = 0.6$). However, both shell cast varieties attracted fewer spat than natural oyster shells (365, n=80, median=4, Q1=2, Q3=6; $p < 0.001$). The long-term effects of the limestone-rich concrete formulation are currently being examined, however, this study suggests that formulations of concrete that benefit oyster spat can be advantageous as an alternative substrate for oyster restoration due to the similar abundances found on both formulations. We suggest that future restoration efforts should consider using alternative substrates that provide benefits to oyster spat and help to reduce overall cost while maintaining optimal recruitment success.

43 The Influence of Poultry Rearing Facilities on Streams and Stream Fish in the Upper Savannah River Basin

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In the South Carolina Piedmont, human influences on water quality and stream organisms are widespread, with streams in this region typically possessing low fish diversity compared to streams elsewhere in the southeastern United States. Most previous studies have focused on the effects of humans on urban streams, with these urban areas being influenced by extensive roadways, travel emissions, and land use change due to urban sprawl. Studies have also suggested that humans influence rural streams as well, though the sources of influence are different. Rural areas in SC are frequently covered by farmland, including both pasture and row crop agriculture, and some areas, especially in Oconee County, feature high densities of poultry rearing facilities (PRFs). As such, during May-August 2016 we studied fish diversity and abundance, geomorphology, water quality, and habitat quality in streams downstream of PRFs to explore the effects of this form of land use on rural streams in this area. Data were compared to that from previous studies we have conducted that examined pasture, row crop agriculture, and forested land covers at sites lacking PRFs. Results suggest that PRFs may actually increase fish diversity, species richness, and overall biotic quality at sites where the predominant land cover is pasture, possibly because these sites also had higher levels of nitrogenous chemical nutrients. In contrast, sites with PRFs that were predominantly forested or agricultural had lower fish abundance. It could be that pastured land covers are more likely to be influenced by PRFs since chicken litter is most commonly spread on fields, though further studies will be needed to confirm such effects. This information can help SC shape its farming and agricultural practices to preserve the ecological integrity of rural streams while also protecting human health by maintaining clean and safe water sources.

44 Effects on *Campostoma oligolepis* digestive morphology and gut microbiota composition across a gradient of urbanization

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Campostoma oligolepis, the Largescale Stoneroller, is a species of minnow native to North Georgia. Our study investigated the impacts of urbanization on gut length and gut microbiota community composition in *C. oligolepis* from four small watersheds within the Etowah River drainage basin with varying levels of impervious surface coverage (ISC). Individuals were collected from each sample site in the summer of 2016 between late July and early September. Individuals were

collected again in the fall between mid-October and mid-November. The gut length to total length ratio was calculated for each individual to allow for fair comparison of gut lengths between individuals of varying ages and sizes. Additionally, gut microbiota communities from summer individuals were identified using 16S metagenomic sequencing on an Ion Torrent platform. We found that summer individuals from watersheds with lower ISC had significantly longer gut lengths than individuals from more urbanized watersheds. These findings were consistent with previous findings from a 2013 study conducted out of the same watersheds. However, no significant difference in relative gut length was found between sample sites for the individuals collected in fall. Sequence data from the summer individuals revealed the presence of twelve distinct bacterial phyla in the *Campostoma* gut contents. Overall, Proteobacteria and Fusobacteria were the two most abundant phyla, with Firmicutes and Cyanobacteria being proportionally more abundant in the hindgut as compared to the foregut.

45 Examining behavior syndromes in *Orconectes durelli* crayfish

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John Niedzwiecki

In order to explain seemingly non-adaptive behavior in animals, researchers often look to suites of correlated behaviors called syndromes. Aggressive behavior in crayfish may be beneficial in scaling conspecific dominance hierarchies, but traits of high aggression could be linked to other novel traits, such as high levels of boldness, which could be detrimental in the presence of a predator. We studied individual performances of *Orconectes durelli* crayfish in a series of test, interpreting boldness as a latency to emerge from shelter following a simulated attack, and scoring aggression based on competitive interactions between size-matched crayfish. We suspected the bolder crayfish of each matched pair to have the higher aggression score. A chi-squared analysis of the test results shows Marginal significance that supports our hypothesis, suggesting that aggressive traits are linked with bold traits. We are running more trials and, if confirmed, our study suggests a potential example of a behavioral syndrome in *Orconectes durelli*.

46 4-Methylcyclohexanemethanol Acute Toxicity to Daphnia and Its Effects on General Esterase and Glutathione S-Transferase Activity in Fathead Minnows

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In 2014, 10,000 gallons of a chemical called crude MCHM spilled into the Elk River in West Virginia. The spill affected nine counties and resulted in the governor of West Virginia declaring a state of emergency. Residents were issued an advisory to avoid all water consumption that lasted up to nine days in the most affected areas. Because there was a paucity of information about the toxicity of this chemical prior to the spill, our research aimed to verify the 48-h EC50 for Daphnia magna (Daphnia) that had been published by the manufacturer, Eastman Chemical Company, as well as expand knowledge on the chemical by examining its effects on two enzyme detoxification systems, general esterase and glutathione S-transferase, in Pimephales promelas (Fathead Minnow). We used pure MCHM instead of the crude form used in Eastman's toxicity tests because the composition of crude MCHM is variable. We measured the EC10,50,90 for Daphnia using immobilization as the endpoint. The EC50 we obtained for pure MCHM did not differ significantly from the EC50 provided by Eastman for the crude form. We exposed Fathead Minnows to sublethal environmentally-relevant concentrations of MCHM for 96 h prior to performing the enzyme assays. The experimental groups in these assays

did not show significant difference from control groups. MCHM may not be an appropriate substrate for these detoxification systems or may have low bioavailability in this type of exposure. Our results add to the general acute toxicity information for MCHM. However, there is still a deficit in chronic toxicity testing that is concerning because of possible prolonged human exposure following the spill.

47 The effects of a trophic cascade and trait-mediated interactions have on the survival rate of the Southern Oyster (Crassostrea virginica)

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Oysters are an important foundation species and how other organisms interact among the reef can better conservation and resource management efforts for oysters. Trophic cascades occur among ecosystems, improving the health and populations of prey items on an oyster reef such as the Southern Oyster (*Crassostrea virgnica*). The feeding rates on the Southern Oyster by two species of crabs found in the Gulf of Mexico were observed using tanks divided into separate chambers. A caged predator was placed in half of the chambers to observe how its presence changed the behavior of the crabs and the amount of oysters preyed upon. The presence of predators, such as the Toadfish and Stone Crab, keep an oyster reef from collapsing by keeping other populations in check. Both Mud Crabs and Blue Crabs will by indirectly affected by the presence of the caged predator and decrease their predation on oyster spat.

48 The impact of a reduced tree canopy cover on the composition of stream macroinvertebrate communities

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Urbanization is one of the leading causes of local extinctions and loss of biodiversity, and canopy cover reduction as a product of urbanization creates physical and chemical changes in streams that may impact biotic community assemblages. Aquatic macroinvertebrates have varying sensitivities to environmental changes; therefore, they may act as bioindicators for poor stream health. This study compares macroinvertebrate diversity and composition in riffles of open canopy and closed canopy segments in two streams, Richland Creek and Little Harpeth River, and diversity was quantified using biotic indices. Indices representing macroinvertebrates by tolerance level indicated no significant difference between sensitive taxa in open canopy and closed canopy sites, while Little Harpeth consistently showed more positive results than Richland in both open and closed. This suggests that the effects of urbanization on stream macroinvertebrate communities in the Nashville area may be less attributed to canopy cover reduction and more so to another environmental player.

49 Status of Federally Listed Mussels in the Upper Pea River Watershed

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Unionids are among the top two most endangered fauna in North America. Recently eight species of mussels were listed under the Endangered Species Act in southeast Alabama in the Choctawhatchee, Conecuh, and Yellow River watersheds. Updated surveys in Alabama have not been performed for many areas

of these watersheds. Our study focused on mussel assemblages of the Choctawhatchee River watershed in the upper Pea River and tributaries, primarily targeting preferred habitat as indicated by Niraula et al. (2015). Multiple sites have been sampled thus far to determine both the presence of federally listed mussels, and the likely reaches in which these mussels may be found. Sampling indicated that *Pleurobema strodeanum*, *Fusconaia burkei*, and *Hamiota australis* are abundant in a few areas, but sparse populations with few individuals are found throughout large reaches of the upper portion of the watershed. Additionally, these federally listed mussels may be limited in the upper reaches of the river and tributaries primarily due to flow restrictions during low water levels. Targeting habitat preferences of these species, especially during low flow, has shown to be highly beneficial, although not always reliable. Furthermore, the now common shifting coarse sand that has flooded our rivers and blanketed habitat throughout the watersheds does not appear to support any of the native mussels as long-term viable habitat.

50 Amphibian and reptile community responses to prescribed burning and thinning in Alabama's Bankhead National Forest

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Periodic ecological disturbances can influence the abiotic and biotic components of a landscape, and are responsible for the long-term persistence of several adapted ecosystems. Prescribed land management techniques can act as surrogates for natural disturbances for the purpose of habitat restoration, but the long-term impact of these measures on wildlife populations is not fully understood. We examined herpetofaunal community responses to an array of prescribed burning and thinning treatments using a before-after control-impact and factorial complete block design over a period of 11 years. Herpetofaunal communities were sampled each year during May-October in 18 separate forest stands (three replicates consisting of five experimental plots and one control) using modified drift-fence arrays. We marked each individual with a stand-specific mark to avoid recounting recaptures. We evaluated shifts in herpetofaunal captures over time (pre-treatment vs. post-treatment) and across treatment types and their interactions using mixed models ANOVA. We employed principal component analysis to define relationships among habitat variables, and tracked those relationships over time. Canonical correspondence analysis was used to analyze the combined influence of forest treatment and treatment year variables on species captures. We observed several species- and assemblage-specific shifts in captures following treatment implementation. Generally, large-bodied snakes and heliothermic lizards were positively associated with the drier conditions and open canopies found in heavily thinned and thin-with-burn stands, whereas amphibians and smaller-bodied reptiles thrived in control and lightly thinned stands that maintained thick canopies and deep, moist litter layers. The implications of our findings on future forest restoration projects and herpetofaunal conservation efforts will be discussed.

51 Ecology of Bald Eagles (*Haliaeetus leucocephalus*) in Alabama

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A knowledge gap exists regarding the ecology of Bald Eagles (*Haliaeetus leucocephalus*) in Alabama. This species was reintroduced by the Alabama Department of Conservation and Natural Resources in the mid-1980s, and the nesting population currently stands at 100-200 nesting pairs. The present study initiated an examination of nest site selection and predation behavior of Bald Eagles

in Alabama. The locations of a subsample of eagle nests were compared with USGS land cover data in ArcMap 10. A buffer of one mile was set around each nest location, and the total acreage of each land use category that was within that buffer was summarized. Additionally, many of these nests were surveyed for discarded prey items, and the presence of turtle remains was noted. A variety of turtle species were documented on the ground beneath nests. If possible, the carapace length and width of the recovered turtle shells were measured to examine potential size limits of turtle prey that Bald Eagles can seize. The two mean carapace lengths of the most observed species, the Eastern Musk Turtle (*Sternotherus odoratus*) and Common Map Turtle (*Graptemys geographica*), were 9.6 ± .6 cm and 11.3 ± 1.2 cm, respectively. Based on these species' contrasting maximum size, Bald Eagles are able to prey on juvenile and adult Eastern Musk Turtles whereas only juvenile Common Map Turtles are susceptible to Bald Eagle predation.

52 Evaluating the Role of Fish as Surrogates for Amphibians in Ecological Risk Assessment

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Ecological risk of chemical exposure to aquatic-phase amphibians is historically evaluated using surrogate toxicity data from standard fish species. Recently published meta-analyses of fish and amphibian ecotoxicity data concluded that both groups are similarly sensitive to a range of chemicals. However, these analyses are limited because the amphibian data reported in the peer-reviewed literature are variable both with respect to experimental design and test species. In 2010, the U.S. Environmental Protection Agency began receiving ecotoxicity data for a standard amphibian test species (Xenopus laevis) as part of the Endocrine Disruptor Screening Program. Although these studies are primarily designed to inform a determination of potential thyroid interaction within the context of other endocrine screening studies, they also contain valuable data on survival and growth that can be compared to existing fish data for a given chemical. We used this dataset to compare no observed adverse effect concentration (NOAEC) values for survival, body weight, and length data between fish and amphibians for 43 different pesticide active ingredients. Overall, the results indicate that fish are a reasonably good predictor of amphibian toxicity as there were no statistically significant differences in NOAEC values between the two groups for the endpoints examined. However, toxicity endpoints were lower in amphibians as compared to fish approximately half the time across chemicals, challenging the notion that fish are consistently more sensitive than amphibians. Disclaimer: This abstract does not necessarily reflect EPA policy.

53 Development of a decision support tool for Birmingham Audubon's Urban Bird Habitat Initiative

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To assist Birmingham Audubon in planning conservation activities for migrant and resident birds in publicly-accessible locations, we are developing a decision support tool to facilitate prioritization of sites for management. This tool is being developed by obtaining information about the features of selected sites related to their potential for bird habitat (e.g., land use, vegetation characteristics, etc.) and public use (e.g., population size of surrounding area, median household income of surrounding area, etc.) then integrating this information into a composite index. The index will consist of several models with uniquely weighted features to facilitate comparisons between four parks: Avondale, East Lake, and Railroad Parks in Jefferson County, Alabama

and Limestone Park in Shelby County, Alabama. Composite index scores are also being compared with species richness and diversity, birder use, and public use data to refine feature weights and create a final set of models to support future decision-making in the greater Birmingham, Alabama area.

54 The Effect of Conventional versus Rotational Cattle Management on Pasture Soil Carbon and Bulk Density: Implications for Climate Change

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In naturally occurring ecosystems, forests function as substantial carbon sinks, storing carbon in soil and biomass that would otherwise exist in the atmosphere as carbon dioxide. However, agricultural fields have the potential to act as reservoirs of soil carbon as well. Rotational cattle pastures, where cattle are moved between enclosed sections of pasture, may improve soil carbon content compared to conventional pastures. In rotational cattle pastures, a more even distribution of manure increases plant biomass, and increased cattle movement decreases soil compaction, thereby reducing erosion and loss of soil carbon. This study quantified differences in soil carbon and bulk density (soil compaction) within and between a high-frequency rotational pasture (HFR), a low frequency rotational pasture (LFR), and a conventional non-rotational (NR) pasture. Soil samples were collected from top, middle, and bottom slope positions and were separated by soil depth (0-10, 10-20, and 20-30 cm). Bulk density was determined using dry soil weights, and soil organic carbon was analyzed with the loss-on-ignition technique. Soil carbon was greater overall in the HFR (6.58%) and LFR (6.68%) pastures compared to the NR pasture (3.47%; $p < 0.001$). Bulk density was also greater in the NR pasture (0.96 g/cm3) compared to the HFR (0.79 g/cm3) and LFR (0.80 g/cm3) pastures ($p < 0.001$). There was no difference of soil carbon ($p = 0.94$) or bulk density ($p = 0.62$) between the HFR and LFR pastures. Soil carbon was also affected by soil depth in all pastures ($p < 0.001$). Soil carbon was not related to slope position in the NR pasture, as was expected (top: 3.30%, middle: 3.30%, bottom: 3.29%; $p = 0.24$). This study suggests that rotational cattle pastures could be one pathway for mitigating climate change through greater carbon sequestration and soil carbon storage.

55 Profiling Bat Species Presence and Activity in Managed Longleaf Pine Landscapes

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Restoration of native flora or reintroduction of at-risk fauna may include controlled forest burns or artificial habitats to encourage presence and breeding for target organisms. These methods may also affect the activity of other wildlife. Bats inhabit key ecological niches in several ecosystems, and are often considered indicators of ecosystem health. An endemic ecosystem undergoing restoration within the southeastern U.S. is that of the longleaf pine (*Pinus palustris*). We investigated the effect of landscape management history and current forest management practices on bat species presence and activity within this system. We deployed bat detectors to passively monitor activity in two wildlife management areas in the Raccoon Creek Watershed of northwest Georgia, USA. These areas differ in landscape management histories and intensity of long leaf pine restoration practices. Results indicate a difference in species presence and activity between regions that differ in landscape management histories, but no significant difference among contemporary restoration practices. The species most active on the landscape appear to be the

big brown bat (*Eptesicus fuscus*) and eastern red bat (*Lasiurus borealis*). Higher bat activity levels were detected within the landscape undergoing more intensive restoration practices and with a land management history involving recent timber harvest. However, there was no significant difference in activity levels between treated landscape and control stands.

55 Seed banking for Resiliency: Seed Collections for Coastal Restoration in the Eastern United States

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Hurricane Sandy caused $65 billion in damage to coastal areas of the eastern United States after making landfall in October 2012. Living shorelines have been found to mitigate storm damage by absorbing flood waters and slowing erosion while requiring less long term maintenance than hardened shorelines. Consequently, the Department of the Interior (DOI) granted over $200 million to coastal restoration projects from Virginia to Maine. To fulfill the plant material needs for these projects, the New England Wild Flower Society (NEWFS), the North Carolina Botanic Garden (NCBG) and the Mid-Atlantic Regional Seed Bank (MARSB) in partnership with the Chicago Botanic Garden (CBG), Cape May Plant Materials Center (CMPMC) and Seeds of Success (SOS) initiated a seed collection program for the Atlantic coast. Project objectives included: 1) compiling a list of native plant species valuable for coastal restoration; 2) making 1400 collections of locally adapted seed ecotypes from 2014 to 2016 in accordance with SOS protocol; 3) coordinating plant material acquisition between restoration projects and propagation facilities. The 1,678 collections to date comprise 169 genera and 301 species, with outreach provided to 28 coastal restoration projects. With the frequency at which it is affected by tropical cyclones, the southeastern US would benefit from an expansion of SOS.

57 Using dynamic occupancy models to investigate inter-annual shifts in seabird distributions in southern New England

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Inter-annual variation must be taken into account when studying seabird distributions, with important areas, or "hotspots," for diving species expected to be more persistent across time than those for surface-feeding species. We avoided confounding seabird distribution dynamics with changes in year-specific detection rates by analyzing a three-year winter-season aerial seabird survey dataset from southern New England using dynamic occupancy models. Spatial variation in probabilities of site-occupancy, extinction, and colonization was modeled using the environmental covariates bathymetry, sea surface temperature, and chlorophyll a surface concentration. Variation in detection probability was modeled as a function of year and survey date. Across eight modeled species we saw high variation in the degree to which predicted hotspot locations shifted between years. Loons (*Gavia* spp.) and sea ducks (Tribe Mergini), with the exception of common eider (*Somateria mollissima*), showed relatively stable distributions across years. Razorbill (*Alca torda*) and all three surface-feeding species showed substantial inter-annual shifts in their distributions. Four species showed significant differences between year-specific detection probability intercept estimates, suggesting that in some cases failing to account for imperfect detection will lead to biased results in studies examining the temporal stability of seabird hotspot locations.

58 Age Specific Patterns in Window Mortality in Avian Populations

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Building collisions, especially window collisions, pose a major anthropogenic threat to birds. Mortality caused by building collisions is estimated to be between 100 million and 1 billion annually, and it is the second largest source in the U.S. for direct human-caused bird mortality. While several studies have focused on the frequency of building/window collisions in avian populations and the role played by temporal differences in abundance during migration, little research has explored the possible relationship between age and mortality in window strike collisions. If juvenile birds exhibit a pattern of higher mortality from window strikes, it might possibly be attributed to less experienced individuals. However, various other factors need to be taken into account including the species specific ratio of adult to juvenile birds and how these ratios might change seasonally during migration. The primary goal of this study is to determine if there is a direct age-mortality correlation in avian window strikes using a large dataset of curated museum specimens that will classify birds by age based on physiological, morphological, and plumage features. There is a paucity of data from southern states, including Alabama, on window strike mortality, and this project will examine window strikes on a regional scale primarily in the Southeastern U.S. Current findings of this project include considering species specific ratios of age groups in avian populations as well as aging avian specimens based on presence/absence of the bursa of Fabricius, a developmental organ currently considered to only be found in juvenile birds. With more increasing anthropogenic threats affecting bird populations, it is vital to study the impact of the threats for preventive measures. In conclusion, the goal of this research is to provide significant implications on how window strike mortality affects avian populations and to identify the driving mechanisms for the conservation of avian populations.

59 Habitat management affects spatial and temporal patterns of genetic diversity

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Genetic diversity within and among populations can be shaped by dispersal and fluctuations in population size. Anthropogenic disturbance, such as habitat fragmentation, has the potential to influence dispersal and population size by altering habitat quality and connectivity. Thus, species with limited vagility and specific habitat preferences may be particularly susceptible to landscape-altering events. Populations of the Florida scrub lizard (*Sceloporus woodi*) within the Ocala National Forest (ONF) are subjected to prescribed fire, fire suppression and clearcutting. Stands of longleaf pine within the ONF are maintained on a biannual cycle of prescribed burning and harbor large populations of *S. woodi*. Meanwhile, clear-cut stands of sand pine scrub (SPS) only temporarily provide suitable habitat for *S. woodi*. We predict that *S. woodi* disperse from stands of SPS as vegetative density increases in the absence of a natural fire regimen. The objective of this study is to quantify temporal and spatial genetic diversity in *S. woodi* populations in the ONF and assess any correlation with habitat management practices. To this end, we used microsatellite markers to quantify genetic variation in *S. woodi* populations from the ONF at two time points separated by approximately five generations. Because a previous mitochondrial DNA (mtDNA) analysis detected a much stronger population genetic structure than did microsatellite markers, we also tested for sex-biased dispersal across continuous and fragmented habitats. Microsatellite markers revealed little to no population

genetic structure, however, our analysis did detect a pattern of isolation by distance which was not found five generations prior. Furthermore, we found evidence of sex-biased dispersal across continuous, but not fragmented habitat. Our results have the potential to elucidate the effects of habitat management on genetic diversity in natural populations and thus, influence management practice.

60 What Contributes to a Successful Program to Recruit and Engage Math and Science Teachers?

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Supported by the NSF Robert C. Noyce Scholarship Program, Newberry College, a small liberal arts college, is in Phase II of Recruit and Engage Math and Science Teachers (REMAST) program. The primary goal of Phase I was to recruit and engage Secondary Education Science and Math majors to provide STEM Secondary Education teachers with strong content knowledge in high-needs school districts. In addition, we provided support to those students (Noyce/REMAST Scholars) through scholarships, content-specific education opportunities, professional development meetings, conferences and meetings, inquiry-based teaching instruction, and support from mentor teachers in cooperating school districts. REMAST Phase II goals include recruiting additional students to the REMAST program and continuing to provide the same opportunities to the students as we did in Phase I. Additionally, during Phase II, 20 Chemistry, Biology, and Math REMAST/graduate teachers with from < 1 to 5+ years of teaching experience can participate in our Professional Learning Community (PLC) of current Noyce/REMAST Scholars, Mentor Teachers, and grant personnel. We have also developed and implemented a research plan to gather data to determine the impact of the REMAST program and the PLC on retention, persistence, and effectiveness in the field of STEM teaching.

61 Using reflective writing as a tool for improving understanding

Jeffrey Thomas, Queens University of Charlotte, Biology, Charlotte, NC, 28205

While curricula and majors are often designed progressively so that students build from their prior knowledge, students do not always see that structure. Courses that isolate or focus on a single biological level may not help students see biological phenomena as emergent properties of the interactions of these systems. As a result, the students' ability to retain and use knowledge from previous courses may be limited. This presentation discusses the use of directed reflection as a tool that can aid student understanding of the current course material and its relationship to material in other concurrent and previous courses in both biology majors and non-majors biology courses. Directed reflection assignments require students to take part in two activities that have been shown in other contexts to improve student learning: reflection on your own learning and writing about science. These low-stakes assignments can be used to engage students in different ways of thinking; aid in building interest or connections with other materials; and serve as valuable checks on understanding throughout the semester. Data from both upper division majors courses and non-majors courses will be included in the discussion.

62 Can You Use Help in Your Biology Laboratories? Teach Your Undergraduates to be a TA.

Irma Santoro, Reinhardt University, Biology, Waleska, GA, 30183

Teaching at a small liberal arts university with limited budgets can be a very challenging prospect in the natural sciences, especially when faculty are required to teach numerous general biology laboratory sections. It is common for faculty at small institutions to have large teaching loads every semester. They are challenged with finding the time to provide the attention and care required to assist new biology majors in a college laboratory setting. Continually faced with this problem, I searched for a solution and realized that I had a plentiful resource of experienced senior students that could provide assistance. An Undergraduate Teaching Assistant (UTA) course was developed to train high achieving undergraduates to assist faculty instructors in the general biology laboratory sections. UTAs learn about and experience many different aspects of teaching a laboratory such as content, pedagogy, and gain confidence in their abilities. UTAs also improve their laboratory research and communication skills. Instructors gain additional support both inside and outside the laboratory. The students enrolled in the laboratory also benefit since UTAs can support student cooperative learning. Moreover, this experience supports the development of the UTA as a teacher, and provides an additional perspective for students in the laboratory beyond the faculty instructor. Experiences, successes, and challenges on developing the UTA apprentice course and the success of the Introductory Laboratories will be presented.

63 International Service Learning for Biology and Health Science Majors

Pearl Fernandes, University of South Carolina Sumter, Science, Math & Engineering, Sumter, SC, 29150

As demand grows for increased global experiential learning, more universities are looking for study abroad experiences for their students. Biology and Health Science majors travelled to Belize with the goal of not only gaining hands-on experience in a global context but also experience cultural connectivity. Students worked with health professionals- doctors, nurses and health workers in make-shift clinics and also conducted house visits in the community. Students also learned to take patient histories and vitals. Presentations on health care were conducted by local health professionals. Feedback gained from students was that the experience not only helped them experience cultural sensitivity but they learned how culture is connected to science and health care. The experience also increased global citizenship and refined career goals. Besides the presenter sharing experiences and best practice strategies, the session will also engage the audience in an active discussion on their experiences and outcomes for international service learning for biology and health science majors.

64 Transcriptional regulation of the *Meis2* locus

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Cortney Bouldin, Ted Zerucha

The *Meis* genes are a member of the homeobox super-family of genes that code for the production of transcription factors. Homologs of the *Meis* genes have been identified in all animals studied and have been found to be expressed in similar patterns during the embryonic development of those animals. The products of the *Meis* genes are able to directly regulate the expression of target genes but are most well-known for functioning as cofactors, directly interacting with other transcription factors as well as DNA to facilitate transcriptional regulation. Most notably, they appear to be acting as co-factors of the evolutionarily well-conserved Hox proteins and have also been described to act with other transcription factors on DNA. Despite being fairly well-characterized in terms of their molecular function and expression pattern during development, little is known concerning how their

expression is regulated. We have identified four highly conserved noncoding elements associated with the vertebrate *Meis2* gene and named them m2de1-4 (for *Meis2* downstream element). While M2de2-4 have only been found in land vertebrates to date, m2de1 is also found in teleosts including zebrafish. Interestingly, these elements are found in the introns of an adjacent gene, *zgc:154061* in zebrafish, whose orthologs are always found in an inverted convergently transcribed orientation directly downstream of *Meis2* in vertebrates. Our hypothesis is that the genomic organization of these two genes has been preserved over time due to the sharing of cis-regulatory elements. To test this, we have examined the expression patterns of *meis2a* and *zgc:154061* as well as the expression of a reporter transgene directed by m2de1 in zebrafish. Currently, we are working on knocking out the m2de1 element via CRISPR/Cas9 in order to determine the effects on the expression of *meis2a* and *zgc:154061*.

65 Modeling gut function with larval zebrafish and transgenic shrimp

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Here we report progress using larval zebrafish as a model to study intestinal function. Our research goal is to develop the zebrafish as a model for human gut motility disorders. The larval zebrafish offers several advantages including a transparent body wall and a straight gut tube. These features allow easy imaging of the passage of gut contents in live fish. This approach will allow us to develop a gut transit assay, which is a measure of the rate of food passage through the gut. To develop the assay, our first step is to determine the average gut transit time in wildtype larvae. In preliminary work, we observed that at 7 days post fertilization (dpf) and 9 dpf, larvae ingested a meal within 10 minutes of delivering food to the tank. Guts were emptied within 4 hours post-feeding. Portion size was controlled to some extent by using live brine shrimp as the meal, rather than a powdered, formulated feed. We observed that larvae appeared to ingest one shrimp at mealtime, with few exceptions. Although shrimp are easily visible through the larval body wall, at later stages of larval growth the gut contents become increasingly obscured by pigmentation of the body wall. Extending our model beyond early larval stages therefore would require a highly visible meal. To address this, we developed a brightly fluorescent meal by generating transgenic brine shrimp that express Green Fluorescent Protein or dtTomato protein. Next, we will test whether fluorescent shrimp will allow us to perform the gut transit assay in older larvae. Ultimately, our plan is to use the gut transit assay to study sox10 mutant fish that have a neuronal deficit in the posterior intestine.

66 The enteroendocrine morphology of the developing zebrafish intestine

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Mary Kinkel

The zebrafish digestive system shares multiple characteristics with the human digestive system, making it a good model for studying disease. During zebrafish development, multiple intestinal cell types differentiate, including absorptive cells and hormone-producing cells that line the intestinal lumen. In larval zebrafish, the intestine is a rather simple, straight tube with apparently few cell types. However, during metamorphosis, zebrafish undergo a transition from the larval stage to the juvenile stage. During this time, zebrafish takes on adult characteristics through dramatic anatomical and physiological changes. These changes include looping of the intestine and a significant increase in length of the intestine. The looping and increase in gut length is one of many anatomical rearrangements that occur during the short period of metamorphosis in which larval fish take on adult characteristics.

We hypothesize that, in addition to the increase in gut length in juveniles, the intestinal epithelium undergoes functional changes. Specifically, we propose that additional cell types differentiate. In preliminary studies, we have identified a critical period of rapid growth and maturation between 9 and 30 days post fertilization (dpf), corresponding to 5 mm and 11 mm in standard body length. Our working hypothesis is that the digestive system, including the intestine, undergoes maturation early in this time window, to allow the fish to keep pace with the energetic demands of rapid growth. To begin to test our hypothesis, we will use histology and immunohistochemistry to map specific cell types within the intestinal epithelium, through a stage series that spans the time window of rapid growth.

67 The Role of Topoisomerase 2β in neural development in *Danio rerio*

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Bonny Millimaki

Topoisomerases are widely known for their role in relieving torsional strain during DNA replication and repair. One isoform of topoisomerase, Top2β, has recently been indicated to also play a role in neural development. Our lab has performed previous studies using the Top2β catalytic inhibitors, HU-331 and dexrazoxane (DEX) to target the 12-24 hour post-fertilization (hpf) primary neural development period in *Danio rerio* (zebrafish) embryos. These previous experiments have shown that loss of Top2β activity results in embryos that demonstrate distinct behavioral and structural changes indicative of Top2β's role in axon pathfinding. We believe that Top2β activity changes the topology of the DNA in a specific manner, allowing proper gene expression important for axon guidance. Real time PCR results have supported this hypothesis. As we further investigate this hypothesis we also continue to determine if Top2β plays an alternate role during earlier stages of neural development while ruling out the influence of Top2β on cell proliferation and death. Together our data help to demonstrate a less characterized role of an important protein.

68 Developing Zebrafish Artificial Stream Microcosms to understand natural water resources

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Georgia suffered a major natural resource tragedy in May of 2011, when there was a mass fish die off in Ogeechee River system totaling in roughly 40,000 fish and many other vertebrates. Point and non-point pollutants within the river and flood plains could have been an undermining because it can lead to fish kills. This study focused on the effects pollutants may be having on the organisms that inhabit this river. We used zebrafish as a model system to assess the effects of Ogeechee river water on fish growth and reproductive effectiveness. Using water and sediments from 6 sites on the River and one control, artificial stream microcosms were created by using 5-gallon tubs with a 2-gallon tub in center forming a donut shape. Then a water pump was added to the tank allowing for continual water movement. In these experiments, 10 zebrafish, 5 of each sex, were placed in each tank for two weeks. The fish were fed daily and the temperature of the water was taken and if needed water was added to the simulated streams. The fish were weighed immediately before and after the treatment to understand the effect of river water on fish growth. After the treatment, at least two pairs of fish were set up for breeding and embryos were collected for evaluating their health. The quantity and the health of the embryos reflect the reproductive soundness of the fish. Further, two pairs of fish were frozen to extract total RNAs. Using qPCR, various stress response and toxicity marker genes are being analyzed to understand the molecular toxicity of river water

treatment. These assays will directly help us understand and identify potential mechanisms for water management.

69 Understanding Tumor Microenvironment Using Humanized Zebrafish Tumor Xenograft Model

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The migration of cancer cells from a primary growth site to a secondary growth site is known as metastasis. However, to intravasate into blood vessels or lymphatics and spread throughout the body, cancer cells must first pass through the extracellular matrix (ECM) - a dense region between cells in tissue containing secreted molecules and proteins that have a wide range of functions, including cell regulation and signal modulation. Due to its denseness, ECM remodeling is likely required for metastatic cells to migrate, which can happen through signaling and/or aggressive cellular behavior. Our preliminary studies have shown that increased expression of the transmembrane protein integrin alpha 6 (*ITGA6*) results in increased metastasis in vivo. Cleavable versions of *ITGA6* results in higher rates of metastasis, while non-cleavable versions show decreased rates of metastasis. Based on this data, truncated versions of *ITGA6* may play a role in ECM remodeling by signaling to surrounding molecules to reposition, allowing malignant cells to migrate. In addition, the cleaved version of *ITGA6* may also be acting as an intracellular signal for cell migration by increasing aggressive cellular behavior. This aggression can be determined by an increase in the number and length of cell protrusions. To visualize how the expression of *ITGA6* affects the velocity and aggression of malignant cells, a humanized zebrafish tumor xenograft system, in which human RNA is expressed and human cancer cells are injected, is used to follow metastasis over time lapse series. The resulting zebrafish model will then be fluorescently labeled for the ECM proteins laminin and cadherin to highlight the extent of ECM remodeling along the migration paths of metastatic cells. Evaluation of the ECM remodeling will provide a better understanding as to the mode of actions employed metastatic cells to move through their microenvironment and the role of *ITGA6* in metastasis.

70 Creating an Autistic Model in Zebra Fish Utilizing CRISPR/Cas9 Genome Editing

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In 2015, Autism Spectrum Disorder (ASD) was estimated to affect 1 in 68 children in the United States. Autism is a neurodevelopmental disorder that can impair a child's ability to communicate and interact with others while also including restricted repetitive behaviors and interests. Although the molecular origins of these impairments are not clearly understood, studies have shown that these defects may originate from abnormal brain development during developmental stages. Topoisomerase 3B (Top3B) is an enzyme that alters the topologic states of RNA during transcription to regulate gene expression within neurons. Preliminary studies with Top3B have shown that defects in Top3B could potentially result in cognitive deficits characteristic of ASD. Due to their phenotypic characteristics and well-known developmental pattern, zebrafish were used as an ideal model organism. We created a CRISPR mutant for Top3B using specific guide RNA and Cas9 injections. Mutant larvae at six days post injection were analyzed by behavioral assays utilizing Daniovision. Our analysis revealed severe behavioral deficits such as reduced exploratory movement and increased circling behaviors similar to human ASD symptoms. We are currently staining and imaging mutant larvae to identify potential

defective neural circuits that may lead to behavioral deficits characteristic of ASD. Elucidating the genetic and molecular mechanism for cognitive deficits associated with autism could potentially lead to targeted preventative measures while also uncovering the developmental biology of ASD.

71 Elemental stoichometry and response to land use of a widespread riverine macrophyte, *Podostemum ceratophyllum* Michx.

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Podostemum ceratophyllum (aka Hornleaf Riverweed) is a widespread and ecologically important macrophyte of mid-order rivers in eastern North America. The plants grows submerged underwater, attached to stable benthic substrate in fast flowing water *Podostemum* absorbs nutrients from the water column, is known to support invertebrate biomass, and is consumed by a diverse assemblage riverine fauna. However, little in known about the quality of resources the plants provide to consumers. Additionally, how land use within the watershed affects the elemental composition of *Podostemum* has only tangentially been investigated. Of particular concern is the possibility that the plants may bioaccumulate heavy metals and pass them into the food chain. We collected *Podostemum* from over 60 locations between Georgia and Maine and using optical emission spectroscopy and isotopic analysis, we examined the elemental composition of *Podostemum* to explore how land use may alter the elemental composition of the plant. Our data indicate that *Podostemum* responds to changes in land use in the watershed and that the plants may be useful as biological indicators of nutrient enrichment in the rivers where they grow.

72 The effects of differing soundscape on avian vocalization and behavior

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John Quinn

Many anthropogenic disturbances have disrupted animals' abilities to carry out basic functions necessary for survival. One such disturbance is the disruption of animal communication by anthropogenic noise through the process of acoustic masking. I examined the effects of such a disturbance on Carolina Chickadees (Poecile carolinensis). I used sound recorders to measure the soundscape in areas across the campus of Furman University in Greenville, South Carolina, and quantified the soundscape by measuring seven different soundscape indices in each recording. I then measured frequencies of Chickadee alarm calls in all the recordings, and tested if vocalization frequency differed in response to levels of anthropogenic noise and in response to soundscape indices. I then observed Carolina Chickadee and Tufted Titmouse (Baeolophus bicolor) behavior in response to high and low frequency Chickadee vocalization playbacks to test the functionality of possible vocalization shifts. Behavioral data is important to determine if vocalization shifts are a method to decrease the effects of acoustic masking, or if the shifts are occurring for other reasons. I found that anthropogenic noise did have measurable impacts on the surrounding soundscape. For example, increasing anthropogenic noise caused a decrease in Biophony and the Acoustic Complexity Index, but an increase in Anthrophony. However, I found that Chickadee vocalization frequency did not change in differing levels of anthropogenic noise or in differing soundscapes. From the behavioral analysis I found that vocalization frequency shifts did not have an advantage in overcoming acoustic masking, possibly explaining this lack of frequency shift.

73 Testing Holling's Textural-Discontinuity Hypothesis Along an Urban Gradient

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Urbanization significantly changes the composition of many animal communities. One possible reason for this is the dramatic alteration of habitat structure that accompanies urban development. In many areas, urbanization leads to the replacement of forests, characterized by complex habitat structure occurring at a variety of spatial scales, with simpler and larger-scaled habitats in the form of lawns, parking lots, and buildings. In other words, habitat structure becomes increasingly coarsely-textured with increasing urbanization. According to Holling's Textural-Discontinuity Hypothesis, an increase in coarsely-textured habitat structure should be associated with an increase in species body sizes. We are testing this prediction using breeding bird and carabid beetle data and high-resolution aerial photographs collected for sites representing a gradient of increasing housing density in Ottawa, Ontario and Gatineau, Quebec, Canada. We have applied wavelet analysis to the aerial photographs to determine the characteristic spatial scales of structure within sites, a measure of their habitat texture. Preliminary results indicate that characteristic scales increase in size with increasing housing density. Separately for each taxon, we will present the results of a redundancy analysis that tests for the effect of habitat texture on the distribution of species among body size classes. Body size classes were those that were identified by three of the following four methods: hierarchical cluster analysis, classification and regression tree analysis, the body mass difference index, and the gap rarity index. Our results hint at a unifying process underlying the effect of urbanization on animal community composition.

74 Soil Respiration Change across Forest Harvest Openings

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Small forest clearings are essential for the creation of early successional habitat and the promotion of biodiversity. However, these clearings created through natural or artificial means alter the way that carbon flows through the forest ecosystem. The soil in clearings is exposed to more moisture, heat, and a new layer of organic matter, and fine root production is altered. These are all factors that have been shown to affect soil respiration (CO2 eflux) rates. We tested differences in soil respiration in open, edge, and forested areas of small (0.4 ha) forest clearings within the Nantahala National Forest in the Southern Appalachians. Four clearings were selected and two sampling transects were set up from clearing center, through intact forest, to an adjacent clearing center, with sample sites established in the open, edge, and forested area of each clearing. We hypothesized soil respiration would be highest near the center of the clearings and lowest in the forest due to different microclimate conditions that promote soil respiration in recently harvested areas. Results were opposite of our hypothesis; soil respiration was highest in the forest and lowest in the open. We believe this could be a result of the hot dry weather in July which inhibited the function of soil microbes. These results could mean that harvesting during the summer could help mitigate the initial release of CO2 that typically follows a harvest. To determine if variation in flux is due to differences in amounts of organic matter soil cores and forest floor samples were collected are being evaluated.

75 Understanding the Past, Present, and Future of Land Conservation in South Carolina

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Urbanization poses a challenge for many ecosystems in the US. However, monitoring its impacts requires extensive data and makes up-to-date information hard to come by. One area that has seen tremendous growth is the Interstate 85 (I-85) corridor between Charlotte, NC and Atlanta, GA, which is known as "The Boom Belt." Unfortunately, due to limited resources data on land use change and its impacts have not been updated since the early 1990s. To investigate how urbanization is impacting this region, we conducted an analysis that examined how urbanization impacted 20 different land cover classes from 1992 to 2015. To do this, we collected satellite images from 1992 - selected by the South Carolina Department of Natural Resources for their Gap Analysis (which represents the most up to date assessment of land use in the state). We compared these images to those from similar seasons in 2015 using imagery from the United States Geological Survey. To assess changes in land cover over time we looked at shifts in NDVI values for all land cover classes. Using these data, we assessed three things: 1) how much land in our 20 classes had been converted to urban area, 2) whether individual classes were differentially impacted, and 3) how the clustering patterns of classes changed over time. We found that while land has been lost to urban development, a relatively low percentage of habitat was converted in our 20 classes. However, not all classes are being impacted equally, and nearly all classes are becoming increasingly clustered, which could significantly impact biodiversity over time. These findings are important because they provide an updated picture of the effects of urbanization on the I-85 corridor. In addition, they suggest there is still time to intervene before more significant amounts of land is lost.

76 Fitness consequences of *Wolbachia* infection and sexual mode in a model egg parasitoid

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Wolbachia pipientis represents one of the most pervasive bacterial infections in the world with estimates of over one million arthropods species infected. Parthenogenesis-inducing (PI) *Wolbachia* in various haplodiploid species effectively feminizes male offspring through a process called gamete duplication and converts the reproductive mode of infected females from arrhenotoky (fertilized eggs undergo female development, unfertilized eggs undergo male development) to thelytoky (fertilized and unfertilized eggs undergo female development). For many species PI *Wolbachia* infection ultimately results in the loss of sexual function. The fitness consequences associated with PI *Wolbachia* are of particular interest to ecologists and evolutionary biologists given the extreme effect that infection has on the reproductive mode of infected individuals. We use a model PI *Wolbachia* infected species, *Trichogramma kaykai* Pinto (Hymenoptera: Trichogrammatidae), to investigate the effects of infection status and mating status on *T. kaykai* fitness. Three genotypically distinct isofemale cultures were used to test whether fitness (number of offspring reaching pupal stage, number of female offspring, and pupal survival) differed among infected unmated, infected mated and antibiotically-cured mated females. Significant survival costs were observed for mated *Wolbachia*-infected females, and fecundity costs were observed for mated and unmated *Wolbachia*-infected females, with significant variation for these costs across host genotypes.

77 Dynamics of a venomous spider introduction to the southeastern United States

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Introduced species can provide opportunities to study the ecological and evolutionary dynamics of newly established and expanding populations. The brown widow spider, *Latrodectus geometricus*, is an introduced species to the southern United States. Over the past 20 years it has expanded its range from southern Florida to most of the southeastern states. This introduced species also carries with it the bacterial endosymbiont *Wolbachia*, which is known to have significant life history effects in other arthropods. This study describes the distribution of genetic variation and *Wolbachia* infection frequency in the introduced range of *L. geometricus*. In addition, life history traits are described in the context of host-symbiont interactions. We found that differences in mitochondrial haplotype frequency are significant among locations. *Wolbachia* infection frequency also differed significantly among sampling locations, ranging from 20% to 92%. The observed distribution of genetic variation and *Wolbachia* infection frequency suggest that recent founder events and possibly limited gene flow among locations sampled. These results also suggest that the *Wolbachia* strain is not an obligate symbiont and that the fitness effects of the host-symbiont relationship are small.

78 Spatial Patterns in Morphology of the Invasive Kudzu Bug, *Megacopta cribraria*

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Recent invasions provide unique natural experiments through which to study the effects of new environments and selective pressures on invaders. As individuals from the invasion core begin to disperse outward toward the periphery of their newly acquired range, morphology can be influenced by various factors. Some such factors include temperature, latitude, distance from the invasion source, and sex. In this study, we examine the morphology of the invasive kudzu bug, *Megacopta cribraria*, across its invasive range in the southeastern United States, as well as factors that may be contributing to the morphological patterns we observe.

79 Metal deposits in the cuticle of cicada ovipositors

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Some insects are faced with the challenge of penetrating or chewing tough materials, such as wood, for reproductive or feeding purposes. In order to do this, natural selection has favored the strengthening of cuticle with deposits of metals. Given the reproductive habits of cicadas (Hemiptera), which require the penetration of wood with the ovipositor to lay eggs, we hypothesized that cicada ovipositors contain metals in the cuticle. We examined the architecture of ovipositors of three cicada species representing two genera using scanning electron microscopy and employed energy dispersive x-ray spectroscopy on ten locations along the ovipositor length. We found that all species do contain metals in the cuticle. The percentage of metals and metal type differ among species. In addition, the presence of metals changes along the ovipositor length, with the majority of metals located at distal regions. This is the first report of metals in the cuticle of Hemiptera and provides an example of convergent evolution where distantly related insects, such

as Ichneumon wasps (Hymenoptera), also have metal deposits in the cuticle of their ovipositors.

80 Antimicrobial properties in butterfly saliva

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Connie Kramer, Matthew Lehnert

Butterflies and moths (Lepidoptera) feed on a variety of fluids including nectar, sap, and juices from rotting fruit and dung, which host a diversity of microbial communities. In addition to feeding on their respective food sources, Lepidoptera also are ingesting the microbes, which raises the question: do Lepidoptera have a method for reducing the ingested bacterial load? Bacteria in food sources could potentially reduce lepidopteran fitness; therefore, natural selection would favor antimicrobial processes, potentially at the interface of Lepidoptera and the food sources. We hypothesized that butterfly saliva contains antimicrobial properties. In order to test this, we collected Monarch butterfly ("Danaus plexippus") saliva and mixed it with Pseudomonas sp. and Micrococcus sp. to study microbial inhibition. Our preliminary research indicates bacterial growth is inhibited in the presence of butterfly saliva.

81 Development of a Hypothesis to Explain Geographic Differences in the Morphology of *Bellamya japonica* (von Martens 1861)

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The invasive Japanese mystery snail, Bellamya japonica, was first detected in the Savannah River Basin in 2006. The snails are also known to have proliferated in Lake Greenwood in the Saluda River Basin. The potential management of any invasive species is dependent on knowledge and understanding of the organism and its ecological relationships in the newly invaded environments. Based upon previous observations B. japonica has different population characteristics related to individual physical size, individual-specific growth, and possibly population growth. Our research will compare the populations of two different lakes with regard to measureable population morphological and population parameters. Previous observations on the Lake Hartwell population indicate a sex ratio of approximately 1:1. The comparative study will compare this to the Lake Greenwood population. Moreover, previous observations also support the conclusion that there are morphological differences in maximum mass and size. We will repeat those observations and also examine for the first time, aspect of shell mass versus soft tissue mass. Previous observations also support a linear relationship between total mass for pregnant females and the number of unborn offspring. This comparative study will determine if there is a difference, in this respect, between lakes. This research will also support the development of testable hypotheses regarding the nutritional and chemical differences in the environment that could possibly explain their population and morphological differences.

82 Assessment of Food Availability of the Larval Eastern Hellbender Salamander (*Cryptobranchus alleganiensis*) in North Carolina and Georgia Streams

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Shem Unger

Macroinvertebrates are indicators of stream health, environmental change, and form complex communities in aquatic ecosystems. In addition to their role as indicators of

stream health, they also provide a valuable food source for many juvenile salamanders, including the Eastern hellbender salamander (Cryptobranchus alleganiensis), as species of special conservation concern. Therefore knowledge on macroinvertebrate diversity is not only an indicator of stream health but also provides additional information on food availability of larval hellbender salamanders, a largely unknown life history stage for the species. During the summer of 2016, we assessed the EPT richness and diversity of macroinvertebrate communities across several watersheds in the Appalachian region, distributed across North Carolina and Georgia concurrently monitored for eastern hellbender populations. We successfully collected and identified over 5,000 macroinvertebrates to the lowest taxonomic level possible across 12 streams with confirmed hellbender populations. Macroinvertebrate communities comprised over 40 genera across streams. Information from this project will be used to model food availability of larval eastern hellbender salamander populations and will provide a deeper understanding of how well conservation methods are working to preserve the natural integrity of Appalachian streams.

83 The effect of freshwater input and seagrass on sediment characteristics in St. Joseph and Apalachicola Bay, Florida

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Troy Mutchler

Understanding nitrogen (N) cycling in estuarine sediments is critical for determining fate of N in coastal ecosystems. Although estimates of N cycling are increasingly common, spatial and temporal variability of these rates, as well as factors driving them, is not well understood in many systems. Freshwater inputs and submerged vegetation, such as seagrasses, may strongly influence N transformations, but their overall effect on N cycling is unclear due to the complex role they play in governing sediment carbon and N pools, redox conditions, and salinity. To quantify the effects of seagrass and freshwater inputs on sediment characteristics, an assessment of sediment grain size, organic matter (OM) content, and ammonium porewater within vegetated and unvegetated areas of seagrass beds is being conducted at six sites across St. Joseph and Apalachicola Bay, Florida. St. Joseph's Bay has no major river inputs, with salinity ranging from 23-40ppt, while Apalachicola Bay receives discharge from the Apalachicola River, with salinity ranging from 10-25ppt. Preliminary data shows that, on average, Apalachicola Bay has higher OM content (2.31% ± 1.33%) than St. Joseph's Bay (1.07% ± 0.81%), while both have similar distributions of sediment grain size. OM content also varies spatially within bays and across vegetated and unvegetated sediments. St. Joseph's Bay OM ranges from 0.61-3.70% across vegetated beds and 0.16-1.17% across unvegetated areas. Apalachicola Bay OM content ranges from 0.27-2.87% across unvegetated areas and 1.12-3.98% in vegetated areas within the bay. Porewater ammonium samples are being processed and values are expected to vary between vegetated and unvegetated areas, as well as spatially between and across bays. Previous estimates of N transformation rates suggest these patterns in sediment characteristics have important implications for the fate of N in different systems.

84 Investigating the Role of Long Distance Dispersal in the Response of Stream Fishes to Urbanization

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William Ensign

We are conducting a mark-recapture study in the metro Atlanta area to investigate the role urbanization plays in long distance dispersal of stream fishes. Our two stream sites represent a heavily impacted urban watershed (impervious surface cover ~ 30%) and a mildly impacted rural watershed (impervious surface cover ~6%). Species of interest, Campostoma oligolepis (n=130 rural site, 137 urban site) and Lepomis auritis (n=152 rural site, 89 urban site), were marked with 12mm HPT PIT tags (Biomark, Idaho) with monthly resampling conducted using a portable antenna. Resampling began in September 2016 and will continue until February 2017. Movement data will be fitted to a dispersal curve in order to determine the proportion of each population displaying long distance dispersal. Comparing intraspecies movement between rural and urban stream site will allow us to determine if fishes utilize long distance dispersal as a means of locating suitable habitat in streams affected by urbanization. Including a generalist species, L. auritis, and a specialist, C. oligolepis, will further allow us to analyze the degree to which fishes may need to employ long distance dispersal based upon their habitat needs. We anticipate a higher proportion of long distance dispersal in urban stream sites for both species with a greater degree of difference between the proportion of long distance dispersal in urban and rural stream sites for C. oligolepis.

85 Developmental and interactive effects of arsenic and chromium to developing Ambystoma maculatum embryos: Toxicity, teratogenicity, and whole-body concentrations

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Anthropogenic activity has contributed to elevated environmental concentrations of arsenic (As) and chromium (Cr). The spotted salamander, [Ambystoma maculatum], may be useful for identifying developmental effects produced by exposure to these contaminants as adults breed and larvae develop in water that may contain As or Cr. Three sample sets among 700 developing larvae were exposed to a range of As, Cr, or 2.5:1 mixture of As:Cr concentrations, respectively. From these 700 larvae, samples containing approximately 24 larvae showed different patterns of whole-body As and Cr from individual and mixture exposure. Whole-body As concentrations were 20.27 and 45.4 µg/g dry weight for larvae exposed to 20 mg/L As and 25:10 mg/L As:Cr, respectively, while whole-body Cr concentrations were 24.8 and 22 µg/g dry weight for larvae exposed to 20 mg/L Cr and 25:10 As:Cr, respectively. Observed malformations included edema, tail kinking, facial deformities, and abnormal bending. Twelve-day lethal concentrations for As and Cr in [Ambystoma maculatum] larvae were 261.17 mg/L and 71.93 mg/L, respectively, while 12-d effective concentrations to induce malformations were 158.82 and 26.05 mg/L, giving teratogenic indices of 1.64 and 2.76 for individual metal exposure. Exposure to a mixture of As and Cr resulted in a response addition and yielded lower lethal and effective concentration values with a teratogenic index of 2.78, indicating that these contaminants are developmentally toxic at lower concentrations when exposed as a mixture. Data demonstrate that As and Cr affect development of amphibian larvae, and that [Ambystoma maculatum] may be a useful indicator of environmental toxicity for these metals.

86 Mass Dependent Metabolism in *Bellamya japonica* (von Martens 1861)

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The invasive freshwater snail, *Bellamya Japonica*, is new to the Savannah River Basin. It was introduced into multiple locations in the United States over 100 years ago and since that time it has infested additional locations. This live-bearing

gastropod seems to be cosmopolitan in habitat preference and is capable of replacing native snail species. Under ideal conditions, it grows to 3-5 cm in diameter, larger than most native freshwater snails in the Southeastern USA. We are studying a population near Clemson University in Lake Hartwell, SC, employing a captive population in an experimental pond. Metabolism is an important component of growth and we have been refining a technique for the measurement of respiration in living specimens. Specimens extracted from the experimental pond are placed in respiration chambers in order to measure oxygen uptake. Mass and other parameters were recorded for each specimen, and respiration was assessed for 24 hours. Oxygen consumption rate was normalized against mass, and our current results indicate that at a constant temperature, metabolic rate is linear with mass. Our studies remain incomplete and we plan to refine them to include additional controlled temperatures encompassing the range that they encounter in nature. We also plan to address nutritional and water quality influences on metabolic rate. In this manner we hope to establish a basis for potential management measures in the future.

87 Resampling to assess variability of the Georgia Index of Biotic Integrity

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Indices of Biotic Integrity (IBI) are used for assessment of the integrity of stream systems by environmental agencies. They assume that the structure and composition of fish community samples reflect environmental conditions in that stream. The approach has a strong ecological base but there has been limited attention given to variability of the IBI. In this study, I use a resampling approach to estimate variability in overall IBI scores and the individual metrics that comprise it. Two streams with differing levels of anthropogenic impact (assessed by impervious surface cover [ISC]) were sampled using the Georgia Environmental Protection Division (GA EPD) IBI protocols. Within each stream, individual sampling units consisted of a single pool-riffle sequence, and 20 pool-riffle sequences were sampled in each stream. Fish were collected from sampling units, identified and enumerated by species, and returned to the unit of capture. To construct data sets for calculation of IBI scores, sampling units were randomly drawn from the entire pool of units for a given stream until the length of stream sampled exceeded that recommended in the EPD protocols. For each stream, 100 randomly drawn samples were obtained and IBI scores calculated. For Little Noonday Creek (LND: ISC ~ 30%) IBI scores ranged from 34 to 44 with a median score of 40 while IBI scores in Pickett's Mill Creek (PMC: ISC ~ 6%) ranged from 40 to 54 with a median score of 48. Richness metrics were relatively stable in LND but composition metrics showed more variability. IN PMC, both richness and composition metrics varied. In summary, estimated IBI scores created using randomly drawn samples from two streams indicate the range of variation in resulting scores is enough to alter the resulting estimate of the systems biotic integrity.

88 Mobile Bay Living Shoreline Suitability Model

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The current trend in the Gulf of Mexico is to install hard structures; such as, bulkheads, groins, or rip-rap on the shoreline to protect waterfront coastal property from erosion. In Alabama 31% of the state's coastal shoreline has been armored with more than 38% of property owners building hard structures for shoreline protection in Mobile Bay. Similarly, over 40% of Tampa Bay's shoreline has been

armored and 20% of tidal marshes in Galveston Bay have been lost as a result of armoring. Hard structures are reducing critical habitat needed for wildlife, recreational opportunities, nutrient recycling, and sustainable fisheries. Several large scale living shoreline projects have been installed in the Gulf of Mexico since 1998. These projects were mainly in undeveloped natural areas, but few homeowners and communities have installed these types of projects. Based on discussions from the greater Gulf of Mexico scientific community more outreach material and decision support tools needs to be created; in order, to promote alternative shoreline protection options. The Gulf of Mexico Alliance funded the implementation of a living shoreline site suitability model for Mobile Bay, Alabama. The model was acquired from the Virginia Institute of Marine Science and the attributes were developed specifically for Mobile Bay using data collected by the principal investigators and obtained from credible sources. The attributes included marsh, erosion rate, tree fringe, cover, beach presence, structure, bank height, bathymetry, sand spit, offshore defense structure, and tributary type among others. The geospatial model has been completed and the GIS (http://www.gsa.state.al.us/apps/CASIS/) viewer displays areas of Mobile Bay that are most suitable for living shoreline treatment types. The GIS viewer outputs include both upland and shoreline best management practices. The viewer also contains other relevant information that can be used to make improved conservation management and development decisions.

89 The impact of human traffic on wildlife abundance on a recreational trail system in Southeastern Tennessee

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Humans impact wildlife in numerous ways. The most obvious is habitat destruction due to the expansion of urban landscapes, farmland, logging, and other activities that consume natural resources. Even in places that are relatively protected, such as wildlife reserves and national parks, humans still exert an impact. One way humans may impact wildlife is simply by their presence. A person walking on a trail through a natural area may alter the behavior of animals in the vicinity by, for example, disrupting normal social behaviors or causing an animal to flee from an important food resource. Constant human traffic on such trails could cause wildlife to avoid what would otherwise be ideal habitat. We tested whether human traffic impacts the abundance of game animals by setting up camera traps within a private trail system used for hiking and mountain biking located in Collegedale, TN, and owned by Southern Adventist University. This trail system contains more than 30 miles of trails through oak-hickory-pine forest habitat. We set up 10 camera stations (two cameras per station) attached to trees and distributed throughout the trail system. These cameras were triggered by motion and used an infra-red flash allowing us to photograph the activity of animals and humans both day and night. The cameras traps were placed on the trail system for six weeks (16 Oct - 27 Nov, 2016). Based on the photographs we quantified the number of humans and game animals seen per day per station. Our talk will present the results of this research and shed light on how the presence of human traffic on recreational trails can impact wildlife abundance.

90 Differential Venom Gland Gene Expression Between *Centruroides vittatus* Size Classes

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Scorpions are well known, venomous arthropods (Class: Arachnida, Order: Scorpiones) occupying a wide variety of habitats. The genus Centruroides (bark scorpion) is commonly found in North America, with habitat ranges from Nebraska to southern Texas. In this study, venom gland gene expression was investigated in IV and I-II size class scorpions. Second generation sequencing technology was employed to characterize the venom gland transcriptome of Class IV and Class I-II scorpions. Results indicate 2,028 contigs (77%) mapped to scorpion species,184 (7%) mapped to higher scorpion taxa, while the remaining 420 (16%) mapped to taxonomic levels higher than the Order Scorpiones. RNA-Seq by Expectation Maximization was used to resolve differential expression between IV and I-II scorpion size classes and was applied to homolog (annotated) and non-homologs (unannotated) Fasta data files generated from each Trinity sequence assembly. Real-time quantitative PCR was used to confirm expression of venom related genes and evaluate differential expression of venom genes for size class IV individuals. Our data suggests there are ontogenetic differences in venom gland gene expression.

91 Highly Invasive Breast Cancer Cell Lines Show a Greater Sensitivity to MAPK Inhibitors by Decreasing Proliferation and Invasion

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Invasive Breast Cancer is the second most common cancer in women, and the second cause of cancer-related deaths. Identification of novel regulators of breast cancer could lead to the identification of new biomarkers and potential therapeutic targets. Neprilysein is a cell surface enzyme that cleaves and inactivates a number of substrates like endothelin-1 that has been implicated in breast cancer. From previous studies published in our lab, neprilysein hypermethylation correlated with decreased epithelial expression. Furthermore, neprilysein negatively regulated endothelin signaling including mitogen activated protein kinase (MAPK) signaling, and breast cancer cell invasion. Therefore, we hypothesized that breast cancer cell lines with hypermethylated neprilysin (MDA-MB-231) would be more sensitive to MAPK inhibition in proliferation and invasion assays than cell lines with less neprilysin methylation (MCF7 cells). We also reasoned that if neprilysin primarily regulates breast cancer invasion through MAPK signaling, neprilysin over-expression and MAPK inhibition will not synergistically inhibit invasion and proliferation. We treated MDA-MB-231 cells with 10uM of the MAPK inhibitor PD98059. Results obtained from MTT proliferation assays and in vitro invasion assays showed a decrease in proliferation and invasion after treatment with PD98059 and transfection with neprilysein as compared to the control However, MDA-MB-231 cells transfected with neprilysein and treated with PD98059 at the same time did not significantly differ from cells transfected with neprilysin alone. Furthermore, the MCF7 cell line did not show a sustained, statistically significant decrease in proliferation after PD98059 treatment, neprilysein transfection, or both. These findings support our hypothesis that cancer cells with hypermethylated neprilysin may be more sensitive to MAPK inhibition, but similar experiments in additional breast cancer cell lines are needed to fully test this. If further experimentation validates our hypothesis, neprilysin methylation could eventually serve as a therapeutic biomarker to identify patients that might respond to MAPK inhibitors.

92 Implementing a DNA barcoding pipeline to prevent the introduction of invasive species into the Port of Savannah

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There are an estimated 5,000 invasive plant species that have successfully established themselves within the United States. Many of these species negatively impact the nation's economy, environment, and agriculture. Over 90% of global trade utilizes sea transportation, so cargo-ships from all over the world visit seaports; these often serve as points of cryptic entry for invasive species. The US Department of Homeland Security, Customs and Border Control Protection (USCBP) intercepts and inspects commodities thereby, preventing invasive propagules from entry. The development of DNA barcodes may provide a method to make more rapid and accurate decisions during inspection, through data basing morphological and molecular data. Molecular identification is conducted through the process of DNA barcoding seeds intercepted from shipping containers. Germination trials are also conducted to assess viability and the resulting germinates will be also be identified using DNA barcoding. The final product combines traditional taxonomy with molecular techniques to assist regulatory agencies (USCBP and USDA-APHIS PPQ) in the prevention of introducing invasive species propagules into the nation.

93 Modeling the Mixed-lineage leukemia (MLL1) multi-protein complex in *Saccharomyces cerevisiae*

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The goal of this project is to define the regulatory mechanisms of the human mixed-lineage leukemia (MLL1) multi-protein complex by modeling the complex in the budding yeast, *Saccharomyces cerevisiae*. H3K4 methylation in mammals is catalyzed by the MLL family of methyltransferases. Chromosomal translocations and other mutations in the MLL1 gene lead to misregulation of Hox genes and can lead to various types of leukemia. MLL1 is associated with a large complex of proteins, several of which are required for the methyltransferase activity of the enzyme. The role of the accessory proteins within the complex associated with MLL1 is likely to regulate the function of MLL1 since some of the proteins are requisite for enzymatic activity of MLL1. Complicating the research of MLL1 is the fact that there are several MLL-like proteins with the same function that are active in mammalian cells. This system is simplified by modeling the MLL1 protein complex in budding yeast. Budding yeast contain a single protein complex referred to as COMPASS (Complex Proteins Associated with Set1), that is homologous to the MLL1 multi-protein complex in mammalian cells. We hypothesize that the accessory proteins associated with the human MLL1 complex regulate the enzymatic activity of MLL1 and that yeast can provide an ideal system to recreate this human multi-protein complex to probe the intricacies of the regulation. The proposed research seeks to examine the protein-protein regulatory mechanisms within the human MLL1 complex using yeast as a model system. We propose the following specific aims: •Construct the human MLL1 multi-protein complex in yeast. •Investigate the interactions between yeast COMPASS and human MLL1 complex members in hybrid protein complexes.

94 Effect of Metal Salts on the Pore Size of Diatoms for Various Applications

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Diatoms are unicellular algae with transparent porous cell walls made of silica. This unique feature has been explored in various fields for myriads of applications to include biosensing, drug delivery, molecular separation, gene delivery, electronic, photonic, optical, and energy production. A major consideration of these applications rely heavily on the cell's pore size among other factors. This study aims to investigate the effect of metal salts, lithium chloride (LiCl) and cesium chloride (CsCl), on the pore size of the marine centric diatom *Cyclotella*, and the freshwater pennate species of *Synedra*, and *Navicula*. Cells were grown in a modified Bold medium using 250 mLErlenmeyer flasks under controlled laboratory conditions. The salts were weighed and added separately to each experimental treatment at 0.5 mM while untreated flasks served as control. Each set-up was prepared in 3 replicates. After 4 weeks of growth, the cells were harvested and collected by centrifugation. One mL of sample from each replicate was allowed to dry and examined under a scanning electron microscope (SEM). Images obtained from SEM of ten cells from each replicate sample were analyzed and pore sizes were measured using ImageJ analysis software in 30 replicates per cell. Results showed that the pore size of *Cyclotella* and *Synedra* cells grown with LiCl, were smaller by 7% and 2.32%, respectively relative to the control while those of *Navicula* were bigger by 9.10%. On the other hand, all of the cells grown with CsCl showed larger pore diameter at 68%, 3.7%, and 36% for *Cyclotella*, *Synedra*, and *Navicula* , respectively. This implies that CsCl generally enhances the pore size of these diatom species whereas the LiCl effect is species-specific. Possible applications of these findings will be discussed

95 The Wnt-signaling gene off-track 2 is required for normal sensory neuron function in *Drosophila* larvae

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Nociception is the process by which peripheral sensory neurons detect noxious stimuli and cause behavioral responses. The sensory neurons responsible for detecting these noxious stimuli are called nociceptors, and their activation is required for the generation of behavioral responses. The mechanisms behind the transduction of noxious sensory stimuli and the resulting behavior are still not fully known. Recently, Wnt-related signaling has been found to play a role in the hypersensitization of nociceptor neurons. We used Drosophila melanogaster as a system to determine the roles Wnt signaling genes in sensory neuron function. We began by compiling a list of Wnt signaling genes based on gene ontology terms, then obtained UAS-RNAi transgenic fly lines to target each gene for RNA interference-induced knockdown. We crossed the UAS-RNAi transgenic fly lines with fly lines that carry the ppk-GAL4 transgene, which causes expression of UAS transgenes specifically in nociceptor neurons. We then tested the larval progeny of these crosses with a well-established thermal nociception assay to measure nociceptor sensitivity. We found an insensitive phenotype for knockdown of the transmembrane receptor gene off-track 2, which suggests that this gene normally supports nociceptor sensitivity. We also found a hypersensitive phenotype for the Wnt receptor genes Frizzled and Frizzled 2, suggesting that these genes normally act to reduce nociceptor sensitivity. Future imaging experiments will determine whether off-track 2 is required for normal dendrite morphology and development,

which may provide insight into the origin of the functional and behavioral phenotypes.

96 Banding Patterns in Human Hair

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The medullated hair shaft consists of three regions that are readily visible by routine light microscopic methods: 1) the outer cuticle, 2) the middle cortex, and 3) central medulla. Despite extensive research on the cortex, the structural basis of bands and banding patterns remains unsettled. In the present study, although we primarily analyzed shafts of scalp hair, we also analyzed hair from other parts of the body. We bleached the hairs to remove cortical and medullary pigments that obstruct full visualization of the cortex and medulla. Some hairs were also stained and/or split. Using light microscopy, we could distinguish two structurally distinct cortical layers in medullated hairs: an outer and inner. Bands form in the outer cortical layer by regular repeating patterns of staggered bundles of longitudinal macrofibrils. Bands are first visible in the upper end of the hair follicle (keratogenous zone), extend continuously along the length of the hair shaft, and end in the hair tip. The banding pattern in the tip differs slightly from the shaft because of the absence of the medulla. Non-medullated hairs share similar banding patterns. The inner cortical layer displays thin transverse fibrils that are oriented perpendicularly to the overlying longitudinal fibers. These fibrils wrap around the medulla's bumpy surface.

97 Effects of stress on astrocytes and hormonal protection

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This study will test the effects of hormones as glial cell protectors when astrocytes are stressed with various toxins including epinephrine, cortisol and low oxygen concentration. Hormone Replacement Therapy (HRT) is used by many women to alleviate menopausal symptoms; a combination of hormones in HRT is often present such as endogenous estrogens, progesterone, and conjugated equine estrogens (CEE) which are taken from the urine of pregnant mares. Previous studies have found positive correlations between certain estrogens such as 17β-estradiol and improved cognitive function. Others illustrated estradiol and progesterone provided a significant protective mechanism for post-ischemic stroke victims. Little is known about CEEs compare to endogenous estrogens in possible neuroprotective effects, but recent research has concluded CEE provide less protective mechanisms as compared to endogenous hormones and may exert adverse neurological health. This study will seek to determine which hormone treatment alone and hormone treatment combination will provide the best protection when neurons are induced with stressors (epinephrine, cortisol, and low oxygen concentration). Human astrocytes will be pre-treated with the following single hormones and combination of hormones: 17a-estradiol, 17β-estradiol, estrone, equilenin, and progesterone. Astrocytes will be exposed to stressors following hormone treatment, and an MTT Assay will be used to detect cell viability. I hypothesize 17β-estradiol will provide the most neuronal protection as a single hormone treatment, and the most significant neuron protection will be the hormone combinations 17β-estradiol with estrone and 17β-estradiol with progesterone. I also hypothesize low oxygen concentration will have the greatest detrimental effects on the neuron-like cells as compared to epinephrine and cortisol. The analysis of this research will help elucidate the relative neuroprotective effects of various estrogens.

98 Filling the need for flexible, practical, right-sized, updatable floras for field use and publication in the Southeastern United States

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Floras serve as basic tools for the identification of plants and to access basic information about their habitats, distributions, classification, and phenology. Yet, they are often frustrating and clumsy tools: covering too large an area (with many extraneous species) or too small (lacking species likely to be encountered), too heavy to practically carry in the field, and with few or no illustrations. Moreover, the large amount of effort and cost to develop and produce a flora for an area means they are only infrequently written or updated, and many areas of our region are covered only by floras that are decades old or are not covered at all -- leaving the user to struggle with out-of-date, partial information. For the Southeastern United States, we have developed a "flora data system" consisting of a relational database with consistent fields of information (species, keys, synonymy, taxonomic changes, distribution, etc.) for the > 8000 vascular plants in the area and a set of R scripts and shapefiles to create custom distribution maps. This system allows the flexible, instant production of floras for any taxonomic group (including the full flora), area (defined by states X physiographic provinces), and/or list of species. The outputted "working flora" has introductory materials, bibliography, and index, includes keys customized and simplified to include only the selected taxa, and species accounts, customized distribution maps of the focal region, and images. Examples of "working floras" could include a flora of Mississippi, of a National Park, state park, or county (based on a list of the species documented for that area), of subtropical Florida, of the Piedmont (from Delaware to Alabama), or of the Poaceae of Tennessee. The "working flora" produced from the FloraManager can be used as is or edited and refined into a more polished document or publication.

99 How many species of native vascular plants are there in the Southeastern United States?

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The set of native species present in an area is a fundamental and foundational basis for scientific studies, land management, conservation, and education. Our scientific account of that set of species changes with time, however, as new species are named, old species are synonymized or "re-recognized" , natives not previously known in an area are detected, and new assessments are made as to the nativity of some taxa. An additional, and underappreciated, factor is the changing definition of what constitutes a species (evolving "species concepts"). Most species in the Southeastern United States were named before Darwinian evolution was hypothesized, and were based on gaps in visible morphological variation. More modern species concepts are explicitly evolutionary and emphasize reproductive barriers, reciprocal monophyly, different evolutionary fates, separate phylogenetic lineages, absence of significant gene flow, and/or differential fitness as criteria used to distinguish between two closely related species. Recent opinion papers and analyses of bird taxonomy (Barrowclough et al. 2016; Gill 2014) suggest that we underestimate the number of bird species in the world by a factor of two; while such a drastic change is partly based on new evidence, it is mostly the result of application of a modern, synthetic species concept. What effect on the number of Southeastern vascular plants would a similar philosophical shift, carefully carried

out, have? Recent studies show that many species and varieties named in the past and later lumped will prove to be good species by modern standards, especially with the implementation of newer molecular technologies. Some species that have never been divided before will prove to be species complexes with semi-cryptic species. While some changes will go in the other direction (lumping or relumping), it seems very likely that the net will be a substantial increase in recognized species, with significant implications for conservation and research.

100 Best practices in lumping and splitting

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The taxonomy of Southeastern United States vascular plant species and infraspecies has accreted over the past 264 years. Over that time, species concepts have changed drastically, new kinds of evidence have been developed, and analytical methods have changed. It is important to realize that the degree to which (and the means by which) the taxonomy of a particular genus (or other group) has been recently and carefully reconsidered is VERY variable; many genera have received little or no study in the past half-century, all the while a sea-change in species concepts and taxonomic evidence has occurred. In these cases, pending new studies (which may not happen for decades more), we tend to base our taxonomic decisions on the last or most thorough study done - but these were often based on out-moded taxonomic concepts and rarely carefully stated the assumptions and philosophies by which taxonomic decisions were made. We here present ideas about effective and scientific ways to critically evaluate past opinions about the taxonomy of groups of organisms. We also suggest best practices for presenting new evidence and taxonomic hypotheses in clear and decisive ways that will facilitate their verification or falsification. Our ability to make good taxonomic deciaions, and evaluate the decisions made by others, is impaired by a pattern of non-critical thinking, mere assertion of taxonomic opinion, temporal fashions in lumping and splitting, a tendency to reach for "silver bullet" solutions, and a failure to consider the importance of the degree of correlation of evidence from multiple fields. We can do better, and need to take taxonomy beyond assertion and hearsay.

101 Floristic and Ecological Inventory of Native Grasslands of the Springfield Plateau, Northwest Arkansas: A Baseline for Restoration

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At the time of Euro-American settlement the Springfield Plateau Ecoregion of the Ozark Highlands supported some of the largest and densest concentrations of native grasslands in Arkansas. The most significant of these occurred in portions of Benton and Washington counties, where approximately 30,000 ha of treeless prairies were mapped in the original GLO land survey (circa 1830). These were embedded within an approximately 300,000 ha matrix of savanna and open oak woodland which also contained a number of other small patch grassland communities. Today the region is largely converted to agriculture (cattle ranching) and urban/suburban uses, with just 81 ha of unplowed prairie remaining in widely scattered, small, isolated remnants of varying quality - a loss of more than 99.7% for that community alone. Despite a growing interest in restoring these grasslands and knowledge of them by botanists for nearly two centuries, no intensive floristic inventories or ecological descriptions have ever been prepared. The current work is based on extensive field work from 2001-2016 as well as inventory of specimens in state and regional herbaria going back to the 1830s. The author's collections focused on protected grassland remnants in the area but also covered selected

roadsides, ditches, rights-of-way and other areas where native grassland flora has persisted. More than 700 taxa of native vascular plants were documented from eight distinct grassland habitats in the region including dry prairie, mesic prairie, wet prairie/marsh, prairie fen, lowland oak flatwoods/savanna, upland oak woodland/savanna, shale glade & barrens, and disturbed grassland. This total includes 65 taxa of state conservation concern, many of which are known only from historical collections. These data provide the best available baseline for ecological restoration work in the region. A summary of this research will be presented along with an overview of the flora, geomorphology, and ecology of the region.

102 The Distribution, Reproductive Viability and Nutrient Status of an Endemic Population of Large-Flowered Skullcap Mint (*Scutellaria montana L.*) in Marshall Forest, Rome GA.

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As part of an ongoing multiyear study of an endangered and endemic population of *Scutellaria montana* L. in Marshall Forest, factors limiting population growth and maintenance are under investigation. Marshall Forest Nature Preserve is a small urban old growth forest located in Rome, GA. Little is known about *Scutellaria's* pollinators or other limiters of reproductive success. The size and patchy distributions of plants or anthesis out-of-sync with the emergence of potential pollinators may profoundly affect successful generation of this small population. This Marshall Forest population has been under investigation for two years. The distribution of patches of plants in the understory have been flagged and counted. Topographical descriptors such as aspect and slope have been correlated to population sites. Manual cross-pollination of a small group of plants yielded seed nutlets collected for determining seed production and viability. Observations of understory ground conditions prompted an investigation into the limitations of nutrient availability through N-nitrate assays, and leaf litter decomposition rates. Pollination rates, seed germination rates, and the establishment and survival of seedlings in the understory conditions of Marshall Forest are under study. Future studies of this population of *Scutellaria* will inquire into soil and litter microbial communities for the presence of nitrogen cycling microbes. Further investigations into the relative success of the Marshall Forest population to nearby protected populations of *Scutellaria* located in Black's Bluff Nature Reserve, Rome, GA are planned.

103 Vascular flora and plant communities of riverscour habitats in Little River Canyon National Preserve, Cherokee and DeKalb Counties, Alabama.

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Dwayne Estes

A floristic inventory of the riverscour flora of Little River Canyon National Preserve (LRCNP) is currently underway. LRCNP is located in Cherokee and Dekalb counties, Alabama in the Cumberland Plateau physiographic province. Little River is one of the longest mountainous rivers in the Plateau with its headwaters originating atop Lookout Mountain in Georgia; it flows southwest into Alabama and descends into the Ridge and Valley, draining into the Coosa River. Riverscours are riparian communities associated with rocky or sandy substrates along high-gradient sections within Little River Canyon. Mechanical scouring from periodic high velocity flash flooding, drought stress, and intolerance to inundation of water are major factors that limit woody encroachment, preventing conversion to forest habitat. The objectives of this study are to document the vascular flora of riverscours at LRCNP by collecting voucher specimens and classifying the natural communities.

Additionally, species of conservation concern and invasive species are being mapped and quantitative data are being recorded to estimate population vigor and size. Two preliminary collecting trips were made in October of 2016, resulting in 252 collections representing 153 species, 52 families, and 111 genera. Six species of conservation concern were documented during the fall of 2016 season including: *Bigelowia nuttallii*, *Coreopsis pulchra*, *Diervilla rivularis*, *Fothergilla major*, *Helianthus longifolius*, and *Rudbeckia heliopsidis*. Future directions will include systematic exploration of Little River to collect voucher specimens, the collection of quantitative data from vegetation plots, and comparison to other recently completed riverscour surveys from the Cumberland Plateau.

104 Mechanisms driving the asymmetrical distribution of *Polystichum acrostichoides* (Christmas fern) on north/south ridges in a southern Appalachian woodland

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Catherine Alexander, Howard Neufeld

On well drained soils in the southern Appalachians, *Polystichum acrostichoides*, or Christmas fern, is often the dominant understory fern, though abundance surveys suggest that it prefers north-facing slopes. An initial survey showed that the average density of this fern was 19.5 vs 0.75 individuals per 5 m2 plot on north- and south-facing slopes, respectively. Christmas fern is "wintergreen," bearing mature fronds over winter. After the first hard frost, fronds reorient from an inclined to a prostrate position, and remain there until replaced by new fronds in spring. We are studying Christmas fern on a series of parallel ridges with north- and south-facing slopes located in the Nature Preserve on the campus of Appalachian State University. Preliminary data suggest that high-light conditions on southern exposures, coupled with sub-freezing temperatures, may cause damage to the photosynthetic apparatus in the winter, though water availability may also play a role. To disentangle the mechanisms driving this distribution, we artificially reoriented mature fronds to an inclined position and are tracking their physiology through winter. Inclined fronds show visible leaf necrosis and significantly lower rates of light-saturated gas exchange (3.1 µmol m^{-2} s^{-1} vs. 4.7 µmol m^{-2} s^{-1}, $p=0.047$) and Fv/Fm (0.690 vs. 0.765, $p < 0.001$) than prostrate fronds. Microclimate data are being collected at frond-level, and we will relate these measurements to frond physiology, lending insight as to why Christmas ferns bear fronds overwinter, why they reorient, and why they prefer north-facing slopes. A greenhouse experiment is planned to gauge drought sensitivity. Forecasted changes in the timing of canopy emergence and senescence, due to climate change, coupled with higher winter temperatures and less snow, may affect the abundance and distribution of this fern by altering its annual carbon relations, which could have significant implications for the ecology of other understory plants in eastern forests.

105 Phylogenetic and Geographic Distribution of Nickel Hyperaccumulation in Neotropical *Psychotria* (Rubiaceae)

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Charlotte Taylor, Joe Pollard

The genus *Psychotria* (Rubiaceae) is large and taxonomically challenging. Hyperaccumulation of nickel in species of *Psychotria* has previously been documented in both the Pacific and Caribbean regions. In the Greater Antilles (Cuba, Dominican Republic, Puerto Rico), six species of *Psychotria* have been reported to hyperaccumulate nickel on serpentine (ultramafic) soils. Three of these species are widespread across the Neotropics on both serpentine and non-serpentine soils. One goal of this research was to determine the broader geographic

distribution of hyperaccumulation in the known hyperaccumulator species, especially in Central America, where metal hyperaccumulation has not previously been reported. Additionally, we investigated five other species closely related to the known hyperaccumulators, to explore the broader phylogenetic distribution of this trait. To obtain the large sample size needed for these studies, we used a handheld X-ray fluorescence spectrometer for rapid, nondestructive measurement of elemental concentrations in specimens from the herbarium of the Missouri Botanical Garden (MO). Our results indicate that nickel hyperaccumulation (defined as foliar Ni concentration >1000 µg/g) occurs in *P. grandis* from Guatemala to Venezuela, and in *P. costivenia* from southern Mexico to Costa Rica. In both species, a wide range of nickel concentrations were found, presumably reflecting variation in metal availability in the soil. Hyperaccumulation has also been reported in *P. viridis*; however, examination of 100 specimens ranging from Guatemala to Brazil revealed no evidence of hyperaccumulation, and we consider earlier reports questionable for this species. Among the related species not previously investigated, we report the discovery of nickel hyperaccumulation in *P. papantlensis* and *P. lorenciana*, but did not find evidence of hyperaccumulation in *P. flava*, *P. pleuropoda*, or *P. clivorum*. Central America, not previously known to harbor any hyperaccumulating species, is now shown to possess at least four closely related hyperaccumulators in *Psychotria*.

106 Examining the Clonal Development of Yellow Toadflax *Linaria vulgaris* in Response to 2,4-D Exposure

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Herbicide management strategies for the containment of the invasive plant populations of yellow toadflax have been known to induce evolutionary modifications in response to herbicide exposure. Among 200 yellow toadflax individuals grown from seed in a common-garden environment, we tested the effects of the herbicide 2,4-Dichlorophenoxyacetic acid (2,4-D) at a concentration of 3.6% throughout various growth stages (2 week intervals) in the yellow toadflax life cycle. As a means for determining the range of successful invasiveness of yellow toadflax individuals relative to its reportedly preferred environments, we established parameters within our experiment testing these independent variables: sandy-loam and loamy sand soil types, high and low precipitation rates, indirect (soil-only) and direct (plant and soil) 2,4-D treatments. Each individual either indirectly or directly received one application of 2,4-D throughout the experiment, and the amount of herbicide application (median: 148ml) was determined by the average biomass of the individuals within each bi-weekly test group. Our results indicate that yellow toadflax individuals can increasingly tolerate 2,4-D applications as they mature and develop into clonal stands via vegetative (asexual) reproduction. Under indirect, sandy-loam, high and low precipitated conditions, the following bi-weekly growth stages indicated the largest percentage of surviving yellow toadflax individuals six weeks after 2,4-D treatment occurred: 6 week treatment (66% survival), 8 week treatment (66% survival), 12 week treatment (83% survival). In addition, the most notable observations in relation to survivorship among yellow toadflax individuals occurred within the direct 2,4-D treatments of week twelve. 41% of individuals in both soil types were able to survive and promote new growth. We found that these results suggest that the plasticity of clonal integration among ramets increases in correlation to the development of the adventitious root system.

107 Chloroplast DNA phylogenetics of the North American *Castanea*
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Jesse Harris, Joey Shaw, Hill Craddock

The North American *Castanea* species (American chestnut and chinquapins) are currently the targets of extensive conservation and restoration programs throughout the eastern United States. Knowledge of the phylogeny and phylogeography of the North American *Castanea* species can be used to guide future conservation efforts. Towards this end, evolutionary relationships and genetic structure of the North American *Castanea* were investigated using chloroplast DNA (cpDNA) sequence data. Six plastome loci were PCR-amplified and sequenced in accessions representing the three currently recognized North American *Castanea* species. Multiple cases of haplotype sharing were documented among distinct chinquapin morphotypes (*C. pumila sensu lato*) and between *C. dentata* and *C. pumila*. Thus, the cpDNA phylogeny did not agree with current or previous taxonomic treatments. The inability to distinguish between deep coalescence and relatively recent interspecific hybridization as the causes of shared cpDNA haplotypes makes phylogenetic reconstruction of the North American *Castanea* species difficult. Because maternally-inherited cpDNA markers did not allow the determination of evolutionary relationships among these species, we recommend that future similar studies in the group employ bi-parentally inherited markers from the nuclear genome.

108 Rarity, Richness, and Randomness: Assessing the Relationship Between Biodiversity and Rarity at Environmentally-Bound Sites
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Kevin Smith

The presence of rare and endemic species is often used to identify areas of conservation priority. It is unclear however, if rare species diversity varies independently of overall species diversity. We created a null model to test whether, through random sampling bias, the presence of locally rare species is primarily a function of overall species richness. We conducted a thorough literature review for biodiversity data from various taxa occupying environmentally-bound sites (e.g., ponds, islands, etc.) and defined rare species as those occurring at 10% or fewer sites in a dataset. To develop the null model, we used a random simulation to predict rare species richness of each site based solely on the total species richness of that site. Our simulation results showed a strong, positive curvilinear relationship between total species richness and number of expected rare species. By comparing the rare species expected by the model to observed rare species, we determined that the random model was a good predictor (R^2=0.83; $p<0.001$), but did not explain the total observed variation. Ultimately, our study suggests that management efforts directed towards regions of high species richness may also conserve rare species of high conservation concern and provides additional evidence for the sampling effect of biodiversity.

109 Host Selection in the Rare Southeastern Parasitic Plant, *Cuscuta harperi*
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Observations of *Cuscuta harperi* (Harper's Dodder) in its natural habitat of xeric sandstone and granite outcrops in Alabama and Georgia have shown that the parasitic vine exhibits a high degree of host specificity. *C. harperi* has been

observed parasitizing a small number of host species endemic to the xeric habitats but is overwhelming found growing on two members of the Sunflower Family, *Bigelowia nutallii* and *Liatris microcephala*. Although *Coreopsis pulchra*, also in the Sunflower Family, is abundant in close proximity to *Cuscuta* seedlings in some populations, this host is largely ignored in favor of *Bigelowia* and *Liatris*. Studies have shown that *Cuscuta* species closely related to *C. harperi* are able to detect volatile organic compounds (VOCs) emitted by host plants and use them as signals to locate these hosts for attachment and formation of parasitic connections. Interestingly, *Cuscuta* seedlings have been shown to grow preferentially toward VOCs from suitable host plants and also to actively grow away from VOCs emitted from plants they are not able to successfully parasitize. We hypothesize that *C. harperi* uses a similar mechanism to distinguish between suitable and non-suitable hosts, and, when given a choice of potential hosts, seedlings will show preferential growth toward those it can successfully parasitize in nature. We observed newly germinated seedlings growing in pots with three potential hosts and a non-living control and recorded their movements and subsequent attachments. Results support the hypothesis that *C. harperi* seedlings are able to recognize and grow toward suitable hosts.

110 Comparative Evaluation Of Wildlife Habitat In A 25-Year-Old Restored Bottomland Hardwood Forest In Response To Three Silvicultural Treatments

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Historically, bottomland hardwood forests of the Lower Mississippi Alluvial Valley have been greatly impacted by land-use change. Strategies for restoring these areas is of great importance to land managers who are looking for ways to improve wildlife habitat. In order to connect two wildlife management areas, Ouachita and Russell Sage, the Louisiana Department of Wildlife and Fisheries purchased and planted an area with native hardwood species. However, these replanted forests provide very little vegetation diversity and often are regarded as providing poor quality habitat. We evaluate the effects of three thinning treatments on a 30-year-old hardwood plantation using measures such as height and cover of understory vegetation, pollinator abundance, invertebrate abundance, and avian species richness over 3 years post-harvest. Treatments applied were a 5-tree retention, 9-tree retention, and an operator selected row thinning. All of these treatments had an average of 56% of the basal area removed. The results of this study indicate that, regardless of which treatment was applied, all of the treated plots had a significant increase in plant diversity, avian and pollinator species richness, structural heterogeneity, and understory cover. However, there was a lack of distinction among the treated plots. This further indicates that the size of the islands formed by the 9-tree and 5-tree retention may not be a difference big enough to show community response differences. However, more work is being done to assess the and differences in assemblages that may help better meet the goals of restoration ecologists.

111 Differences in Seed Dispersal Metrics Between Rare and Common Trilliums is Related to Disperser Preference for Common Species

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Charles Kwit

Comparing ecological aspects of rare species with widespread, co-occurring congeners can reveal differences accounting for species rarity. Trillium is a genus of myrmecochorous (ant-dispersed) understory herbs native to the Southeast

containing both endemic and common species. To investigate whether rare trilliums experience lower seed dispersal effectiveness than their more widespread relatives, seed dispersal probabilities and dispersal distances were recorded for three sympatric rare-common Trillium species pairs at eight study sites across the southern Appalachians. Common species had significantly higher dispersal probabilities for all three pairs (X2(1)=93.87, p<2e-16; X2(1)=50.62, p=1.12e-12; X2(1)=8.432, p=0.003687), and, with the exception of one pair, significantly greater dispersal distances (X2(1)=78.43, p<2.2e-16; X2(1)=64.09, p=1.19e-15; X2(1)=28.29, p=1.044e-07). Laboratory experiments aimed at determining ant preference for seeds of rare and common congeners were also conducted. Seeds collected from each species pair were presented to captive colonies of Aphaenogaster rudis, a keystone disperser. During an observational period of 60 minutes, numbers of rare and common seeds taken into nests were recorded. Following trials, each seed was assigned a behavioral score corresponding to the highest level of interaction it experienced. Colonies were revisited after 24 hours, and numbers of rare and common seeds within and outside nests were recorded. More seeds of common species were taken into nests in 60 minutes (z = -2.604, p = 0.0092) and after 24 hours (t = -5.197, p = 2.10e-06). Seed treatment was related to numbers of seeds scored for each behavioral category (X2(3)=12.1459, p=0.0069). Results suggest that rare and common co-occurring Trillium congeners experience differential seed dispersal rates and dispersal distances in the field, and that these inequities may be attributable to ant preferences for the seeds of common species.

112 Genotype, Vegetation structure, and Interspecific Interactions Predict Distribution and Abundance of *Solidago* Specialist Aphids in the Genus *Uroleucon*

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Ray Williams, Martin Fenn

Mechanisms of host plant recognition are important for understanding what drives interactions between plants and herbivorous insects. Though volatile terpenes are often used by plants as herbivory deterrents, some compounds can act as semiochemicals, both priming nearby plants and acting as colonization stimulants. This is especially relevant for insects that are host specialists and may have the ability to avoid inducing host defenses. This investigation focused on the interactions of tall goldenrod, *Solidago altissima*, goldenrod stem galling insects, and specialist aphids in genus *Uroleucon*. Using plants in a chamber study we demonstrated that *Eurosta solidaginis* galls indirectly induce a terpene response in *S. altissima*. Previous work with this galling species found a lack of chemical induction in plants containing galls. In addition, our laboratory has shown that a *Solidago* specialist aphid was found in greater abundance on ramets with high terpene production. Taken together, these findings suggest that a ramet's chemical response to gall insects could function as an allomone deterring the inducing species, while simultaneously functioning as a kairomone, signaling aphid colonization. Building on previous work we constructed a spatial model of interspecific induction in three discrete genets of *S. altissima* driven by gall formation to predict areas of aphid colonization. In an old-field ecosystem, we measured terpenes in leaves using gas chromatography from plants sampled at varying distances from galls. To map estimated aphid abundance within each genet, ramets were sampled on a grid transect and aphid counts were made at each sample point. The model-based maps were compared with the map of field observed aphid abundance via fuzzy kappa comparison to reveal fair to substantial

concordance across observed genets and time. When taking into account vegetation structure, this model demonstrates the kairomone function of the terpene response and improves predictive accuracy.

113 The Presence of a Non-native Alters Pollinator Activity of a Native Plant Species on Nantucket Island, Massachusetts

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Queen Anne's Lace (*Daucus carota*, QAL) is a non-native plant species that was introduced to North America from Europe, and its presence on Nantucket Island, Massachusetts has been documented since at least the nineteenth century. Research in other plant systems has investigated whether native pollination was affected by the presence of a non-native, and the results are mixed. A native may be negatively affected, may not be affected or may be positively affected by the presence of the non-native. A population survey was performed on QAL, and a pollinator observation study was performed on QAL and a native species, Toothed White-top Aster (*Sericocarpus asteroides*, TWTA). Pollinators were observed for three hours per day and five days each for the 2 species individually and both species cohabitating together. Additionally, a removal treatment was performed on sites where both species cohabitate. The sites were first observed as described on day one. QAL umbels were then removed from the site and pollinators were observed on TWTA as described the following day. Finally, TWTA populations from a range of distances from QAL were assayed for the presence and degree of heterospecific pollen. We had four hypotheses: 1) QAL would be present across Nantucket Island; 2) The presence of QAL would increase pollinator visitation rates and diversity indices on TWTA; 3) The removal of QAL would restore pollinator visitation rates and diversity indices to those found on sites with only TWTA; 4) Higher levels of heterospecific pollination would be found on TWTA in populations located close to QAL. We found QAL to be abundant across the island. While both plant species are generalist-pollinated, QAL attracted 15 insect families and TWTA attracted only 8, with the majority being flies and bees. Each removal treatment received at least 50 % fewer pollinator visits after QAL was removed.

114 Resource allocation drives variable mechanisms of survival after sand deposition

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Sand dunes are important geomorphic formations of coastal ecosystems; and are critical in protecting human populations that live in coastal areas. Dune formations are driven by ecomorphodynamic interactions between vegetation and sediment deposition. While there has been extensive research on responses of mid-Atlantic dune grasses to sand deposition, mechanisms of acclimation have had little focus for common dune-building grasses such as; *Ammophila brevilígulata* (C3), *Spartina patens* (C4), and *Uniola paniculata* (C4). Our goal was to determine how and why physiological mechanisms of acclimation to sand burial vary between species. We tested two hypotheses: 1) resource allocation after burial is predicated on photosynthetic pathway and 2) each species possesses distinct physiological mechanisms that promote survival during a burial event, benefiting uptake of limiting resources. In a greenhouse experiment we exposed three dune grass species to different burial treatments: 0 cm (control) and a one-time 25 cm burial. At the conclusion of our study we collected a suite of physiological and morphological

functional traits. Results showed that *A. breviligulata* decreased allocation to aboveground biomass to maintain root mass; preserving photosynthesis by re-allocating nitrogen (N) into light exposed leaves. Conversely, *U. paniculata* and *S. patens* decreased allocation to belowground production to increase elongation and maintain aboveground biomass. Interestingly, *S. patens* exhibited signs of rhizosheath fixation (as seen in δN15) under control conditions, but shifted from fixed N to available N when buried. Variability in resource allocation is driven by differences in resource efficiency caused by different photosynthetic pathways. When changes in resource allocation occur it leads to interspecific differences in mechanisms of acclimation to sand deposition among the three species.

115 Population Distribution of Three Common Caribbean Sea Urchin Species in Belize

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Sea urchins play a vital ecological role in maintaining the health of coral reefs. Corals need sunlight for survival. They depend on tiny endosymbiotic microalgae, known as zooxanthellae, to carry out photosynthesis and produce nutrients for them. As marine grazers, sea urchins reduce the growth of macroalgae on reefs. By reducing macroalgae growth, urchins reduce the species that compete with corals for access to sunlight. In order to develop a broader understanding of the population ecology of sea urchins, we investigated aggregation patterns of three species that occur near Calabash Caye, Belize: Long Spine Sea Urchins (*Diadema antilarrum*), West Indian Sea Eggs (*Tripneustes ventricosus*), and Slate Pencil Urchins (*Eucidaris tribuloides*). Very little is known about the dispersion of these species in the Caribbean. In May 2016, we collected data at Alligator Island, located off the coast Calabash Caye, Belize. Using a plotless technique, we randomly sampled point-to-individual distances of Long Spined Sea Urchins (N=20), West Indian Sea Eggs (N=20), and Slate Pencil Urchins (N=30). For each species, we calculated an Index of Aggregation value, A. When A=2, the population has a random distribution. We then used a modified t-test to determine whether each A value was statistically different from 2; A>2 indicates a clumped distribution, and A<2 indicates a hyper-dispersed distribution. Long Spined Sea Urchins had an A value greater than 2, meaning they were clumped. The A value of West Indian Sea Eggs was less than 2, meaning they were hyper-dispersed. Slate Pencil Urchins were randomly dispersed because they had an A value that was not significantly different from two. These results suggest that urchin species display different aggregation patterns, due possibly to varied habitat and feeding preferences.

116 Creating a microcosm to examine salinity tolerance of *Escherichia coli* in beach sand

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Escherichia coli (*E. coli*) is a gram-negative bacteria species that thrives in a variety of environments around the world. Due to its widespread prevalence, it is commonly used as an indicator for fecal pollution and other pathogens. One place where it is not often looked for is oceanic beaches because *E. coli* is inhibited by salt. However, recent research has shown that *E. coli* can thrive in sand at oceanic beaches. To determine how the bacteria persists in sand, we created a microcosm simulating the intertidal zone of an oceanic beach. Using this microcosm, we examined how varying levels of salinity (0-6%) affect the persistence of lab strain *E. coli* and an environmental isolate of *E. coli* in these sandy environments. We found that there was a negative correlation between increasing

salinity and the most probable number of *E. coli* colony forming units, which suggests that *E. coli* is being inhibited by salinity to a degree. However, we still found that *E. coli* was able to persist at all salt concentrations including those that exceed normal oceanic salinity. Our results also suggest a difference in salinity tolerance between the lab strain and environmental isolate of *E. coli*. Collectively, our findings suggest that *E. coli* may be able to persist on sandy beaches despite the stress of salinity and may be a useful tool in the future for assessing these ecosystems for fecal contamination levels.

117 Macrolichens of Kentucky's Land of 10,000 Outcrops on Cumberland Mountain in Harlan County, Kentucky

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Lichens constitute a symbiosis between fungi and algae. Macrolichens include foliose and fruticose growth forms. The lichen biota of Kentucky is poorly known. The purpose of this research was to inventory the macrolichens of the Cranks Creek Wildlife Management Area and the Stone Mountain Wildlife Management Area/State Nature Preserve, two contiguous, state-owned properties comprising 1284 ha on Cumberland Mountain in Harlan County. The mountain is a long ridge straddling much of the Kentucky-Virginia border. Geologic strata of Cumberland Mountain are typically steeply slanting to nearly vertical in places. The inclination of the strata, in conjunction with the fact that erosion-resistant sandstone layers alternate with more easily eroded formations, has resulted in a series of cliffs or sharply tilted outcrops that are encountered as one ascends from the base to the summit of the mountain. Some outcrops are expanses of lichen-covered rock while others have mosaics of shrub-bryophyte-lichen "islands" in a "sea" of lichen-covered sandstone; collectively, these support one of Kentucky's finest assemblages of lichens. The three main watersheds within the study area, Troublesome Creek, Mill Branch, and Mill Creek, though mainly supporting young forests, add to the regions' macrolichen richness as they support taxa requiring more mesic conditions. Two hundred ninety-seven specimens collected during 17 field trips to the study area yielded 109 species. *Bryoria furcellata*, *Cetrelia chicitae*, *C. olivetorum*, *Lasallia pensylvanica*, *Melanelia culbersonii*, *Menegazzia terebrata*, and *Pannaria conoplea* are considered new reports for Kentucky. Several significant lichen communities, including "Thunder Rock" , "Pycnothelia Knob" , "Mosaic" , and "The Barrens" were documented.

118 Developing Genetic Markers in Vetiver (*Chrysopogon zizanioides*)

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Vetiver (*Chrysopogon zizanioides*) is an introduced species that has the potential to become invasive in the U.S. This tropical grass is part of the tribe Andropogoneae (Poaceae), which contains some of most aggressive weeds, including *Imperata*, *Miscanthus*, and *Microstegium*. Vetiver is cultivated in the Americas, Australia, Africa and Asia for the perfume industry as well as traditional medicine. More recently vetiver cultivars have been developed for erosion control, due to its deep roots system and drought resistance. "Sunshine" , a sterile variety, has been introduced into the U.S. for the purpose of erosion control, however, there are no morphological characteristics (except sterile flowers) that differentiate the sterile Sunshine, from non-sterile varieties. Thus, there is a chance that non-sterile genotypes could enter the U.S. and possibly become invasive. The purpose of this study is to develop genetic markers to differentiate between the sterile and non-sterile genotypes. Four million Illumina sequences were generated for vetiver using

genomic DNA from the Sunshine cultivar. Bioinformatic software MSATcommander identified 5083 sequences with microsatellite repeats regions, containing two to six base pair repeats in arrays of at least 10 to 20 units. A total of 46 primer pairs were developed for these microsatellite repeats and were screened against the USDA and Australian National Seed Bank vetiver collections. Initial genotyping, resulted in a total of eight potential primer pairs that are currently being further examined. Results of these experiments will be presented.

119 Genetic Diversity and Population Structure in the Clonal *Trillium recurvatum*

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Trillium recurvatum is a long-living herbaceous perennial plant found in the central and eastern United States. It is currently threatened in Michigan and rare in Wisconsin. Threats to this plant include: forest management practices, land-use conversion, and habitat fragmentation. Pollen limitation also threatens this plant as the species is self-incompatible so one genetic individual must be pollinated by a different genetic individual. *T. recurvatum* is clonal, so pollination could be difficult if there are few different genetic individuals in a specific region. My research project aims to explore the genetic diversity of *T. recurvatum* in the University of Memphis Meeman Biological Field Station. This will provide the first population genetics for Shelby County populations of *T. recurvatum*. In March 2014, 220 *T. recurvatum* leaf samples were collected from a population at the University of Memphis Meeman Biological Field Station. The DNA was extracted from these leaves using a commercially available kit, Omega Biotek E.Z.D.N.A Plant DNA Kit, and stored at -80 degrees Celsius. Following that, PCR was performed on all 220 samples for the 10 microsatellite loci. Locus 2,3,4,7,9, and 10 were pooled and run on a capillary electrophoresis at the Molecular Research Core at The University of Tennessee Health Science Center where the instrument can detect one base pair differences. The alleles were recorded using the software package GeneMarker, and the data was analyzed for genetic and clonal diversity using the GenAlEx software. These results were correlated with the demographic data collected by Dr. James Moore and colleagues. Based on the data analyzed, the genetic diversity of *T. recurvatum* was higher than expected. 108 unique genotypes were found from 182 plants sampled, which means there is 60% diversity.

120 The diversity of populations and genetic structure of the rare endemic *Geum radiatum*

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Geum radiatum Michx (Rosaceae) commonly known as Appalachian Avens, is a high-elevation rock outcrop, federally endangered, Southern Appalachian endemic herb, which is widely recognized as a relic species. *G. radiatum* is a charismatic plant, historically sought after by botanists, which has resulted in negative affects from botanical collecting and has received considerable conservation attention. *G. radiatum* is a hexaploid (2n=6x=42) and little is known about it's genetic diversity, population interactions, and the long and complicated history of conservation which has included such methods as introductions, reintroductions, and augmentation of populations. Previous genetic work has focused on highly conserved allozyme loci or comparative studies between *G. radiatum* and *G. peckii* using RAPD's. This study has sampled populations across the narrow range of *G. radiatum* and employed 11 microsatellite markers to explore the genetic diversity of this species. Using these genetic resources along with oral and historical information about conservation activities and the discrete nature of populations of *G. radiatum* it

becomes possible to assign individuals into original populations before plants were moved to augment and/or reintroduce and to describe the current genetic structure of extant populations. The majority of the genetic diversity was identified in the largest populations, and the most unique populations were geographically isolated on the periphery of the species range. This information provides a greater understanding of the genetic structure of populations and should be utilized to sustainability protect the most valuable populations *G. radiatum* and help this imperiled ice age relic species survive on a warming earth.

121 An exploratory study comparing the bacterial community in the guts of wild and lab-raised *Anopheles quadrimaculatus*

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The adult life-stage, and vector competence, of the mosquito is thought to be affected by the aquatic environment of the larval stage. The microbial community obtained from their rearing environment is suspected to be one key factor in this interplay. There remains a lack of understanding of the effects of rearing environment on the adult microbiome of lab-reared mosquitoes compared to wild mosquitoes. This explorative study used lab-strain *Anopheles quadrimaculatus* reared in 1) standard laboratory settings 2) lab setting using water from a native habitat. As a control we included 3) an analysis of the gut microbiome from wild adult *An. quadrimaculatus*. Illumina-based 16S amplicon sequencing was used to determine the eubacterial content of the midguts from the adults. Early analysis shows lab-strain mosquitoes reared in field water were more diverse in their bacterial content than those reared under normal laboratory conditions. The preliminary analysis has also shown that lab-strain mosquitoes, despite rearing environment, contained larger quantities of *Asaia sp*. bacteria compared to wild mosquitoes. The differences in the midgut content as a result of rearing environment could be important for understanding Anopheles-Plasmodium responses. Ongoing analyses and designs of upcoming experiments will be discussed.

122 Small RNA sequencing identifies miRNA roles in ovule and fiber development

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MicroRNAs (miRNAs) have been found to be differentially expressed during cotton fibre development. However, which specific miRNAs and how they are involved in fibre development is unclear. Here, using deep sequencing, 65 conserved miRNA families were identified and 32 families were differentially expressed between leaf and ovule. At least 40 miRNAs were either leaf or ovule specific, whereas 62 miRNAs were shared in both leaf and ovule. qRT-PCR confirmed these miRNAs were differentially expressed during fibre early development. A total of 820 genes were potentially targeted by the identified miRNAs, whose functions are involved in a series of biological processes including fibre development,metabolism and signal transduction. Many predicted miRNA-target pairs were subsequently validated by degradome sequencing analysis. GO and KEGG analyses showed that the identified miRNAs and their targets were classified to 1027 GO terms including 568 biological processes, 324 molecular functions and 135 cellular components and were enriched to 78 KEGG pathways. At least seven unique miRNAs participate in trichome regulatory interaction network. Eleven trans-acting siRNA (tasiRNA) candidate genes were also identified in cotton. One has never been found in other plant species and two of them were derived from MYB and ARF, both of which play

important roles in cotton fibre development. Sixteen genes were predicted to be tasiRNA targets, including sucrose synthase and MYB2. Together, this study discovered new miRNAs in cotton and offered evidences that miRNAs play important roles in cotton ovule/fibre development. The identification of tasiRNA genes and their targets broadens our understanding of the complicated regulatory mechanism of miRNAs in cotton.

123 Dynamics of Retrotransposons in Grass Evolution

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Kristy Lewis, Matt Estep

Transposable elements (TEs) are repetitive sequences found within all eukaryotic genomes that possess the genetic mechanisms necessary to move locations within their host. The repetitive fraction of plant genomes has historically been viewed as "junk DNA" . A growing body of evidence suggests that repetitive sequences play a large role in the evolution of species and may influence diversification rates. Using bioinformatic approaches we mined nine million, 250 base pair illumina reads from four grass species closely related to maize (*Zea mays mays*) and have identified 121 Long Terminal Repeat-Retrotransposons (LTR-RTs). These include TE's previously identified in maize (3) and novel LTR-RTs (118) using the 80:80:80 homology rules for identification. Using these identified TE's we are able to calculate the abundance of each element within the sampled grass genomes and using a phylogenetic framework, map changes in copy number to examine the dynamics of LTR-RTs proliferation and extinction within the grass lineages. Using this bioinformatic approach we can begin to examine the complex relationship between grass diversification and the proliferation of the TEs contained within their genomes.

124 Patterns of selection acting on transcribed and anonymous microsatellites in latitudinal populations of common sunflower (*Helianthus annuus* L.)

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Research has implied a potentially adaptive role for genic or transcribed microsatellites in locally adapted natural populations. However, our understanding of evolutionary pressures acting on this specific class of microsatellites is currently lacking. In this study we used latitudinal populations of common sunflower (Helianthus annuus L.) as a model system to contrast and compare the relative strength of selection acting on transcribed microsatellites with that on anonymous microsatellites which are assumed to evolve neutrally. Here, we conducted a comprehensive population genetic study with 672 individual sunflower plants across 17 natural populations spanning the latitudinal range from Manitoba to Oklahoma. Genetic structure and variation were estimated at 19 anonymous and 13 transcribed microsatellite loci. The results indicated that populations were polymorphic for all loci. The mean number of alleles was higher in anonymous microsatellite loci (17.158) compared to transcribed microsatellite loci (9.923). The expected heterozygosity estimates ranged between 0.741 and 0.922 for anonymous loci and between 0.303 and 0.878 for transcribed loci across all populations. The mean expected heterozygosity estimates were 0.853 and 0.745 for anonymous and transcribed loci respectively indicating higher levels of genetic diversity at anonymous microsatellites in comparison to transcribed microsatellite loci. An Analysis of Molecular Variance (AMOVA) indicated that most of the observed variation can be attributed to within populations for both anonymous (94.6%) and transcribed (93.52%) loci. The mean Fst across all transcribed loci (0.071) was

significantly higher compared to that of anonymous loci (0.054) (Mann Whitney U test, P value = 0.026) indicating stronger selective pressures acting on transcribed microsatellites. The study provides substantial evidence to allow further research to test a potentially adaptive role for transcribed microsatellites in sunflowers.

125 Ecological and evolutionary influences on body size and shape in the Galápagos marine iguana (*Amblyrhynchus cristatus*)

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Oceanic islands are often inhabited by endemic species that have undergone substantial morphological evolutionary change due to processes of multiple colonizations from various source populations, dispersal, and local adaptation. GalÃ¡pagos marine iguanas are an example of an island endemic exhibiting high morphological diversity, including substantial body size variation among populations and sexes, but the causes and magnitude of this variation are not well understood. We obtained morphological measurements from marine iguanas throughout their distribution range. These data were combined with genetic and local environmental data from each population to investigate the effects of evolutionary history and environmental conditions on body size and shape variation and sexual dimorphism. Our results indicate that body size and shape are highly variable among populations. Sea surface temperature and island perimeter, but not evolutionary history as depicted by phylogeographic patterns in this species, explain variation in body size among populations. Conversely, evolutionary history, but not environmental parameters or island size, was found to influence variation in body shape among populations. Finally, in all populations except one, we found strong sexual dimorphism in body size and shape in which males are larger, with higher heads than females, while females have longer heads than males. Differences among populations suggest that plasticity and/or genetic adaptation may shape body size and shape variation in marine iguanas. This study will help target future investigations to address the contribution of plasticity versus genetic adaptation on size and shape variation in marine iguanas.

126 Determining the Role of Ecology in the Diversification of Peninsular North American *Paronychia* (Caryophyllaceae)

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Ecology can play an important role in the speciation process, regardless of whether species diverge into novel ecological space (= ecological speciation), or ecology is conserved among close relatives (= phylogenetic niche conservation; PNC) and speciation occurs into geographically isolated, but ecologically similar habitats. The contributions of both processes, however, are not always easily identifiable because of the complexities of measuring niches. We tested the above hypotheses in the southeastern U.S. populations of *Paronychia* (Caryophyllaceae). We examined diversification across three ecological axes: habitat, soil chemistry, and bioclimate. An allopatric model was tested that made predictions based on the formation of new habitats as sea levels lowered and sand ridges formed. Although *Paronychia* in conservative in occurring on sandy, dry, and open soils, we identified much ecological variation, where species occupied greater ecological space within than between species. Despite substantial variation, speciation did not occur along any of the three ecological axes, and we rejected the ecological speciation model; however, the PNC and allopatric models that makes phylogenetic predictions based on when habitats were formed were supported. Our findings suggest that PNC is

important in the speciation process when similar disjunct-habitats form, but that the niche envelopes can be quite broad.

127 The long-term impacts of fire on material inputs and primary producer responses in Long Pond, FL, USA: Evidence from the sediment record.

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Prescribed fire is a common and promoted forestry management tool used to maintain forest health throughout the USA and many other countries. The burning of understory can recycle nutrients, prevent intense forest fires, and promote tree health. The ash and material that remains following a prescribed burn has been shown to potentially alter water quality by increasing pH, nitrogen, phosphorus, dissolved organic carbon and turbidity. While these changes to water quality are established, much less research has been conducted on the effects of these changes to aquatic organisms and specifically the algal community in lake ecosystems. In this study we collected a sediment core from Long Pond, FL, a shallow, sinkhole lake located in the Osceola National Forest that had received fire ash for decades. Paleolimnological measurements of charcoal fragments, nutrients (C, N, P), stabile isotopes, and photosynthetic pigments were used to reconstruct natural and prescribed fire regimes, inputs of materials and primary producer responses for periods of prescribed burns and natural wildfires (~4,000 YBP). Results show that prior to the beginning of prescribed burning, the lake experience episodic wildfires, but modern prescribed burns were much greater in intensity and material inputs. In addition, influxes of charcoal from burn events correlated with chlorophyte signals from pigment data showing that burning could cause ecological change but signs of eutrophication were not inferred.

128 Spatio-temporal variations in climate-growth relationships of longleaf pines (*Pinus palustris*) in Ocala National Forest, Florida

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Annual tree growth rings are sensitive indicators of long-term and year-to-year variations in climate. We used dendrochronological techniques to investigate spatio-temporal variations in climate-growth relationships of longleaf pines (*Pinus palustris*) over the past century at the site scale. Individual trees within longleaf pine-wiregrass ecosystems were sampled in north-central Florida within the Ocala National Forest, where oceanic conditions dominate the humid subtropical climate. This region is characterized by hot, humid summers and mild winters, and precipitation is abundant, yet a seasonal monsoon-like pattern typically results in dry winters and wet summers. This regional climate pattern implies that annual tree growth should be more limited by precipitation than temperature; however, observations from 149 longleaf pine tree cores indicate growth responses are not uniform across the 20-hectare site. From these results, we hypothesize that temporal changes in climate-growth relationships may be spatially dependent, where tree water stress during summers with below average precipitation (1) increases as proximity to competing *Quercus* species increases, yet (2) decreases as proximity to sinkhole ponds increases. Investigations about summer water stress impacts on longleaf pine growth are scarce, and this study can provide valuable information about the acclimatization of longleaf pine trees, and the impact of future climate scenarios on the structure and function of longleaf pine-wiregrass ecosystems.

129 Classification of dry coniferous forests and woodlands of the southern Appalachian Mountains

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Xeric to subxeric coniferous forests and woodlands of the southern Appalachian Mountains with a substantial component of yellow pines (*Pinus echinata*, *P. pungens*, *P. rigida*, and *P. virginiana*) have declined in area during recent decades because of fire suppression, drought, and outbreaks of southern pine beetle. The net result of these processes has been a shift in many yellow pine communities to dominance by drought-tolerant broad-leaved trees and shrubs. The possibility of a change in the global conservation status of yellow pine communities from vulnerable to imperiled prompted us to reconsider their existing classification, given the important supporting role of classification in conservation efforts. Even prior to widespread decline of yellow pine communities, classification efforts were hampered by their dynamic nature and their tendency to intergrade with a variety of other communities. We have been exploring numerical classification of a data set consisting of over 1,000 permanent plot records extracted from the Carolina Vegetation Survey database, selected using criteria of location in the southern Appalachian region and having at least 10% combined cover of the four yellow pines. After homogenizing species' taxonomic treatments and identifying outlier stands, we have used a combination of *a priori* assignments and quantitative methods (hierarchical cluster analysis and fuzzy clustering) to identify subsets of plot records corresponding best to the principal associations currently in use for these communities in the US National Vegetation Classification (USNVC). Our current focus is on the utility of a core group of 11 USNVC associations currently recognized and the potential need to modify the existing classification structure. Ongoing analyses include numerical classification, ordination, determination of diagnostic species, and the identification of environmental constraints and dynamic trends affecting the distribution of southern Appalachian yellow pine communities.

130 Changes in tree species distributions in Great Smoky Mountains National Park reveal legacies of disturbance

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In the southern Appalachians, complex topography creates gradients of temperature and moisture that influence tree species distributions. Whittaker's (1956) classic work in Great Smoky Mountains National Park (GRSM) illustrates how species occupy different niches along the dominant gradients of temperature (elevation) and moisture (local landform characteristics). However, when the park was formed in the 1930s, anthropogenic disturbances such as settlement, logging, grazing, and chestnut blight had already transformed most of the park's forests. Since then, although strong directional climate trends have been delayed in the southern Appalachians, human influence on these recovering forests has continued, in the form of fire suppression, atmospheric deposition, several introduced pests (e.g., balsam woolly adelgid), and more. In this study, we investigated changes in the topographic niche of 36 tree species in GRSM using 1930s forest survey data and a compilation of forest data sets from the 1990s-2000s. We used presence-absence logistic regression modeling in a Bayesian hierarchical framework to model probability of occurrence for each species with respect to elevation and landform

index, across the two time periods. We further assessed niche changes with respect to species traits representing Grime's plant strategies (competitor-stress tolerator-ruderal triangle). As expected, species targeted by particular disturbances contracted or collapsed in probability of occurrence along topographic gradients. Fast-growing, primarily long-lived disturbance responders and generalist species expanded (primarily toward lower elevation) or increased in probability of occurrence; conversely, slow-growing, heavy-seeded, light-demanding species contracted or decreased in probability of occurrence. Overall, the changes illustrate how widespread forest succession from multiple, interacting anthropogenic disturbances influences the realized niche of tree species, and the results have implications for projecting future species distributions with climate envelope models under future climate scenarios and more.

131 Directional pollen and seed dispersal in a warming Southeast

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Selective pressures of a rapidly changing climate in southeastern North America and elsewhere will result in three possible outcomes for many species. These include (1) niche shifts through plasticity or evolution, (2) migration to track current niches, or (3) extinction. The first two cases, and even population-specific examples of the third (extinction), may be influenced by gene flow, which in seed plants can occur via pollen and seeds. Directional constraints on pollen and seed dispersal, which are presented here in the context of the Southeast, may affect the ultimate outcomes. Pollen movement from south to north, or from lower to higher elevations, could provide beneficial genetic combinations to offspring locally dispersed in such locales; however, lagging flowering phenologies at more northern or upslope locations may limit realized pollen flow. Moreover, seed dispersal of a number of Southeastern species, particularly those with fleshy fruits, occurs during autumn when migratory birds consume substantial amounts of fruit and travel in a general southerly direction, thereby placing propagules in less favorable settings. These generalities present opportunities in the Southeast to study contemporary gene flow-from both pollen and seeds-in fleshy-fruited plants at the leading and trailing edges of geographic ranges at broad (latitudinal) and fine (altitudinal) scales. Well-designed studies could lead to inferences on the relative importance of pollen vs. seed dispersal in current subpopulation/metapopulation persistence, and the importance of directionally-relevant long-distance gene flow events.

132 Herpetofauna Occupancy of Tidal Swamps

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Tidal freshwater forested wetlands (also referred to as 'tidal swamps') provide habitats for a variety of herpetofauna. However, the herpetofauna community composition of tidal swamps are currently unknown. In addition, tidal swamps are currently facing a number of natural and anthropogenic threats, such as saltwater intrusion, and the impacts of these threats to tidal swamps on herpetofauna species have not been assessed. We are examining herpetofauna diversity along a pre-existing salinity gradient (created by prior saltwater intrusion) in tidal swamps on the Savannah River near Savannah, Georgia. We sampled for herpetofauna species with visual encounter surveys, anuran vocalization surveys, automated recording devices, dip nets, cover boards, and several types of aquatic traps. Sampling was conducted at Savannah National Wildlife Refuge from March-May 2016, and sampling will be repeated from March-May 2017. We are using occupancy modeling

to compare site occupancy and species richness at sites along the salinity gradient while accounting for imperfect detection probabilities. We will examine the effects of water and soil salinity, forest canopy cover, and water quality metrics on occupancy. Our goals are to: create a species inventory, determine community composition, utilize occupancy modeling to infer how saltwater intrusion and other associated changes impact the herpetofauna, and document possible microhabitat use.

133 The potential for physiological and behavioral responses to minimize the risk of extinction under climate change

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Warming climates are predicted to reduce global biodiversity by rapidly accelerating the risk of extinction. However, many ecological predictions under climate change are based upon statistical relationships between species richness and the predicted warming under human-caused climate change. As a consequence, these predictions ignore important processes, such as physiological and behavioral plasticity, that are predicted to minimize the threat of climate change. We estimated the potential for physiological and behavior plasticity to minimize the risk of extinction in a global hotspot of salamander diversity. We predicted that physiological plasticity had the potential to reverse current projections that estimate widespread extinction across the salamander diversity hotspot in the southern Appalachian Mountains. Due to the ecological significance of water loss physiology in amphibians, we measured the physiological plasticity of skin resistance to water loss during seasonal changes in temperature and humidity. Then, we developed a physiologically-structured species distribution model that integrated plasticity based upon empirically-derived capacities to adjust skin resistance to water loss. Behavioral plasticity was based upon the well-established behavior of salamanders limiting activity during unfavorable climatic conditions. Physiological and behavioral plasticity improved estimates of habitat suitability by 27% throughout their current geographic range, but neither physiological nor behavior avoidance abated the eventual loss of the vast majority of amphibian habitat in one of the most species-rich regions on the planet. However, estimates of extinction relied heavily on the thermal sensitivity of energy intake, identifying alternative mechanisms that could maintain biodiversity in the southern Appalachian Mountains under climate change.

134 Relationships between land cover/land use, nutrient concentrations, and turbidity of headwater streams in the South Carolina Piedmont

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In recent decades, the Piedmont region of the southeastern United States has experienced rapid land transformation, especially with the expansion of urban areas into rural landscapes. Nonetheless, rural land covers and land uses, including forested and agricultural lands, remain widespread. Therefore, it is important to understand how various land covers and land uses influence water quality in drainage waters in the region. Between 2011 and 2016, we sampled 79 first to fourth order streams in the South Carolina Piedmont under baseflow conditions. These streams included 10 streams in heavily urbanized watersheds. The remaining streams drained rural watersheds ranging from completely forested to those with varying mixtures of forest, pasture, and/or row crops. Poultry farms were located within some of the rural watersheds, as well. Water samples from all streams were analyzed for major ions, total dissolved nitrogen (TDN), dissolved organic carbon, and turbidity. Among rural streams with negligible (<1.5%) crop cover and no poultry farms, TDN concentrations correlated positively with percent of

watershed area in pasture. However, turbidity did not correlate with pasture cover. Streams in "agricultural" watersheds with pasture and row crops and/or poultry farms had the highest TDN concentrations and turbidity. Streams draining watersheds with >80% forest cover and no poultry farms had the lowest TDN concentrations. The lowest turbidities tended to occur in streams draining heavily forested or urban watersheds. Nitrite and phosphate concentrations were typically near or below our detection limit in most streams but were elevated in some watersheds with pasture and/or crop cover. Our results suggest that, in the South Carolina Piedmont, even small areas of row crops and the presence of poultry farms in rural watersheds can result in stream nitrogen (and in some cases phosphate) concentrations that equal or exceed concentrations in highly urbanized watersheds.

135 Nutrients modify the effects of predation in simple aquatic communities

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The distribution and abundance of a species across space is determined by a variety of processes. Nutrients and predators are two factors that can interact to influence the abundance of populations. In this study, we test for the effects of nutrient enrichment, predation, and their interaction with a factorial mesocosm experiment. Snail (Physa acuta) populations were established in mesocosms before creating a gradient of three nutrient (N+P) levels and adding dragon fly larvae (Erythemis simplicicollis) as predators. We found that predators reduced snail density but not snail standing stock. Nutrients alone had no effect on snail density or standing stock. However, the effect of predators on snails depended on nutrients. Predators were most effective at reducing snail standing stock at intermediate nutrient levels. The results of this experiment add to a growing body of literature on the context dependence of predators. Nutrient enrichment of aquatic ecosystems can alter species interactions with unexpected consequences for population growth of prey species.

136 Large effects of consumer offense on ecosystem structure and function: Implications for water resource management

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Study of the role of within-species adaptation in ecological dynamics has focused largely on prey adaptations that reduce consumption risk (prey defense). Few, if any, studies have examined how consumer adaptations to overcome prey defenses (consumer offense) affect ecosystem structure and function. In multiple field experiments, we manipulated two sets of genotypes of a planktonic herbivore. Daphnia pulicaria, in a highly productive ecosystem with abundant toxic prey, cyanobacteria. The two sets of consumer genotypes varied widely in their tolerance of toxic cyanobacteria in the diet (i.e., sensitive vs. tolerant). We found a large effect of tolerant D. pulicaria on phytoplankton biomass and gross primary productivity but no effect of sensitive genotypes, this result stemming from genotype-specific differences in population growth in the presence of toxic prey. Interestingly, the effect of tolerant consumers scaled positively with productivity. Such findings have important implications for the management of harmful algal blooms, which usually occur in productive systems.

137 Adipose-Derived Mesenchymal Stem Cells and Porcine Acellular Muscle Matrix Scaffolds for Skeletal Muscle Tissue Engineering and Regenerative Medicine

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Kathryn Steverson, Ariba Naz, Natalie Mseis, Elizabeth McAbee, Melissa Barr, Hannah Hopfensperger, Stephanie Colburn, Matthew Stern

Skeletal muscle is endowed with a remarkable capacity for regeneration following small-scale damage such as that incurred during exercise and everyday activities. However, when damaged on a larger scale, skeletal muscle is incapable of complete regeneration, and patients are left with inadequate options for restoring lost muscle mass and function. The fields of tissue engineering and regenerative medicine are poised to address these shortcomings through a variety of strategies that take advantage of novel biomaterials and capitalize on the regenerative capacity of stem cells. We hypothesized that 1) an acellular scaffold of clinically-relevant size composed of porcine skeletal muscle extracellular matrix would support the growth of seeded myogenic cells and 2) the culture of adipose-derived mesenchymal stem cells as three dimensional spheroids would alter their gene expression and enhance their myogenic potential. Our results demonstrate that the porcine acellular muscle matrix scaffolds support the infiltration and growth of myogenic cells. We also found that spheroid culture of adipose derived stem cells altered gene expression and can improve myogenic differentiation of the cells in culture. The novel biomaterial and method of priming mesenchymal stem cells for myogenic differentiation described here represent two additional tools that can be incorporated into strategies for improving the engineering and/or regeneration of skeletal muscle tissue.

138 Examining the effect of convallatoxin, a cardiac glycoside, on the growth of colorectal cancer cells

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Colorectal cancer is one of the most commonly diagnosed types of cancer, accounting for approximately eight percent of all new cancer diagnoses and approximately nine percent of all cancer-related deaths. Given these statistics, it is important that we continue to explore novel treatments that are effective at stopping the growth of these lesions. Cardiac glycosides are sugar-based molecules that have traditionally been used due to their ability to regulate the contractile function of cardiac cells. One of these molecules, convallatoxin, has been previously reported to induce cell cycle arrest in some cancer lines through its action on the Na+/K+ ATPase pump. For example, previous research has shown that convallatoxin is effective at slowing the growth of both osteocarcoma and cervical cancer cell lines in vitro. In this study, we examine the effect of convallatoxin on the human colorectal cancer cell line, HCT116. Following treatment, we observed a decrease in cellular viability that is both time and dose-dependent in nature. In addition, we observed a significant decrease in mitotic cells, and a significant increase in apoptotic cells following exposure to convallatoxin ($p<0.05$). Lastly, we utilized an isogenic cell line lacking both alleles of p53, one of the most commonly-studied tumor suppressors that is critical for inducing apoptosis in response to a number of antitumoral compounds, to analyze the necessity for this signaling pathway in response to convallatoxin exposure. In conclusion, our data suggest that convallatoxin is an effective compound, in vitro, to inhibit the proliferation of colorectal cancer cells. Our data also suggests that further research should be considered to evaluate the efficacy of convallatoxin to additional colorectal cancer cells, both in vitro and in vivo.

139 Investigating the anti-proliferative effects of the sesquiterpene Beta-Caryophyllene on HCT116 cells

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Beta-Caryophyllene is a natural bicyclic sesquiterpene widely found in the essential oils of many common herbs and plants. The biologic properties of B-Caryophyllene have experimentally demonstrated anti-proliferative, antioxidant, antimicrobial, and anti-inflammatory effects. In this experiment, we investigated variances in the anti-proliferative effects of B-Caryophyllene on the isogenic human colorectal cancer cell line HCT116 with wild-type p53 (+/+) and HCT116 without p53 (-/-). Both conditions showed a dose-dependent response in cell growth inhibition to treatment with increasing concentrations of B-Caryophyllene. The nontoxic dose of 150uM B-Caryophyllene significantly decreased the mitotic cell count in the p53 (+/+) HCT116 by over 50% in the first 24-hours. The same IC50 value was used with the p53 (-/-) cells for consistency, however there was only a 10% decrease in the first 24 hours. This discovery advocates that the presence of p53 may play a role in the effectiveness of B-Caryophyllene as an anticancer agent

140 Insight Into the Chemotaxis of *Caenorhabditis Elegans* Toward Pathogenic *Bacillus Thuringiensis* Strain 4A4 Using Chemosensory Deficient Nematodes

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Caenorhabditis elegans (C. elegans) is a model organism that is widely used in biological research. One of these areas of study involves the understanding of how *C. elegans* react to different types of pathogenic bacteria, such as *Bacillus thuringiensis* Strain 4A4 (Bt). Bt-a type of environmentally compatible pesticide-in its sporulated form has been shown to be not only be extremely lethal to *C. elegans* but also appears to attract *C. elegans* toward it. However, it is unclear as to what exactly is attracting *C. elegans* to the bacteria in the first place. One theory is that the bacterium emits specific chemicals that *C. elegans* can perceive through specialized cilia and sensory neurons-those that can detect either volatile chemicals (olfactory) or water-soluble chemicals (gustatory). A series of chemosensory deficient *C. elegans*-those with mutations in the sensory neurons AWA, AWC, and ASE-were used in a chemotaxis assay to help determine the chemical nature of Bt. Upon statistical analysis, it would appear that the most significant difference in the attraction of *C. elegans* towards Bt involve the double knockout mutation of both AWA and AWC, which ultimately affected the ability of the worms to sense volatile chemicals in its environment. However, the results also indicate that it is possible that more than one type of chemical is being emitted from the bacteria. Further biochemical analysis of the bacterium itself could lead to a better understanding of its exact chemical make up and thus the nature of the attraction.

141 A morphological analysis of *Rhododendron minus* (Ericaceae) in the Carolinas

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Rhododendron minus (sensu lato), of the southern Appalachian Mountains has been subject to taxonomic speculation. For example, *Rhododendron carolinianum* has been recognized as a distinct species by Rehder (1912) based on its shorter and wider corolla tube and its earlier flowering time despite commonly being found

at higher elevations. Overall, distribution is unusual with a high density of populations occurring in the mountains and scattered populations extending into the piedmont and even the coastal plain along rivers and adjacent streams. During 2015 and 2016 flowering specimens were collected from populations in southwestern North Carolina and in South Carolina to measure 19 vegetative and flower morphological characters. Elevation and flowering date were added to look for correlations between factors. Principal Components Analysis provided separation of populations based on a combination of features, including calyx length, corolla color, corolla length, corolla lobe width, anther pubescence and style length. Graphical analysis of flowering date, flower color and elevation revealed a clear pattern for white-flowered forms (flowering April to May) with populations at higher elevations flowering later, while purple-flowered populations all flowered in early June, regardless of elevation.

142 Hallmark Features of Stem Anatomy in the Family Lamiaceae

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Lamiaceae is a cosmopolitan family, containing around 236 genera and 7,534 species. The family has been the object of considerable taxonomic controversy and ultimate revision, especially concerning subfamilial and tribal limits. A broad-based anatomical approach has been undertaken as a part of this study to assess this as a reasonable systematic technique. Stem anatomy of several members of the family were compared. Sections were made using the recently invented hydromicrotome, fixed, and examined at magnifications of 40x, 100x, and 400x. The common anatomical features of the species sectioned were determined, and used to establish a basic guide to the hallmark stem features of Lamiaceae. Such data provides a basis for future investigation, and will aid in the classification of newly described species and the reevaluation of those already established. Furthermore, some species in Lamiaceae without the characteristics deemed common to the family are given special examination as outliers from the norm.

143 The origin and evolution of *Buchnera* L. (Orobanchaceae) in the Americas

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Buchnera, with approximately 100 species, is the largest genus in tropical clade of Orobanchaceae. More than eighty of these species are distributed in the paleotropics, with the center of diversity in central Africa. Sixteen species occur exclusively in the neotropics, with the majority of species diversity occurring in southern Brazil. Two species occur in the US, and these are hypothesized to be closely related. *Buchnera floridana* is distributed from the gulf coast of Texas through coastal Carolinas, while *B. americana* can be found from west Texas to southern Ontario. Closely related genera to *Buchnera*, including *Cycnium*, *Sopubia*, and *Striga* are distributed in paleotropics, suggesting a paleotropic origin of the genus. Phylogenetic analyses of four chloroplast genes and the nuclear rDNA internal transcribed spacer was performed for 22 paleotropical and 13 neotropical species of *Buchnera*, and included 30 outgroup terminals. Results indicate a single neotropical origin of *Buchnera*, with the first split separating a primarily Central American and Mexican clade from a primarily South American clade. Sister species *Buchnera floridana* and *B. americana* arise from the South American clade, and likely obtained their current distribution by dispersal through

the Antilles into North America, rather than by expansion through Central America and Mexico.

144 Reintroducing the Green Violet

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Recent molecular phylogenetic investigations of the violet family (Violaceae) by the author and collaborators have revolutionized our understanding of genus-level lineages, their traits and their names. The largest impact has been the explosion of so-called *Hybanthus* groups across the whole family, indicating that the unifying trait of a large bottom petal relative to the shorter lateral and upper ones is not an evolutionarily conserved trait. We now recognize nine genus-level lineages out of *Hybanthus*, several of which were new at the time of the phylogenetic investigations. Some have received new names and new circumscriptions, others will be addressed shortly. For temperate botanists the big change is discovering that our Green Violet, *Hybanthus concolor*, is not quite a *Hybanthus* and should now be treated under the old name *Cubelium concolor*, the sole representative of its genus. I will present the peculiar features that set it aside from subtropical/tropical *Hybanthus*, and will touch briefly on a few other hybanthoids in the U.S. that also do not belong in *Hybanthus*.

145 Phytoextraction of Lead from Firing Range Soil by Kudzu

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Lead from soil and dust have been related to elevated blood lead levels which is a concern since lead is a neurotoxin. A previous study indicated that kudzu (Pueraria *montana*) has ability to phytoextract lead from in a hydroponic system and hyperaccumlate lead with the addition of a chelator ethylenediaminetetraacetic acid (EDTA). This study was conducted to determine the efficacy of kudzu to extract lead from soil and if kudzu has an increased affinity for lead in the presence of EDTA. Lead contaminated soil was collected from berms of a shooting range near Dalton, GA. Control soil was collected on the Dalton State College campus. Three month old kudzu plants were planted in a soil mixture of 40% sand, 40% contaminated or control soil, and 20% peat moss. Plants were watered with and without 2% EDTA and leachate was collected. After 3 months, plants were harvested, separated into shoots and roots, and dried. Dry mass was determined. Plant and soil lead concentrations were determined by subjecting samples to acid digestion (USEPA Method 3051). Digested samples were analyzed for total lead concentration using flame atomic absorption spectroscopy. Kudzu grown in lead contaminated soil had lead concentrations of 300-662 ppm in roots and 358-488 ppm in shoots. Transfer factors (shoots:roots) ranged from 0.79-1.85. Kudzu grown in lead contaminated soil and watered with EDTA had lead concentrations of 758-1146 ppm in roots and 385-983 ppm in shoots. Transfer factors ranged from 0.40-1.12 ppm. These data show that kudzu does bioaccumulate lead and concentrations increase in the presence of EDTA. Because of its large biomass, kudzu may be a candidate for phytoextraction.

146 Sorting out history and recognizing the true Habranthus concolor (Amaryllidaceae)

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Lindley (1838, Proc. Hort. Soc. London 1: 8-9) first published Habranthus concolor as having a “pale green whole-coloured flower.” J. G. Baker (1888, Handbook of the Amaryllideae.p. 36) considered the “Perianth-limb lemon-yellow.” Twentieth-century

taxonomists generally used Baker as their guide to rain-lilies. Mrs. Morris Clint (1955, Re-discovery of Zephyranthes concolor. Plant Life 11:33-47) described the flower as "a light rich yellow with a hint of green in the color complex." Traub and Clint (1957, Plant Life 13:68-69) described H. immaculatus as having a perianth "pure white, light greenish-yellowish throat, lower portion of tepalsegs and tepaltube tinged greenish on the outside." Flory & Flagg (1959, Plant Life15:51-54) from bulbs received from Mrs. Clint found that the taxon (H. immaculatus) predominantly white adaxially had 2n=22 and the one predominantly yellow ("H. concolor") had 2n=36, clearly two different species. Our surprise came when Gerald and I obtained a digital copy of Lindley's second publication of H. concolor (1845, Edwards Botanical Reg. 31 t. 54) and saw a beautiful illustration that looks just like H. immaculatus. Thus, H. immaculatus is a synonym of H. concolor. The yellow taxon remains to be named, and it differs from H. concolor in having predominantly yellow vs. white pigmentation adaxially in the perianth segments, a smaller perianth, generally shorter stigmatic lobes and 2n=36 vs. 2n=22.

147 Results of a multi-year benthic meiofauna community survey of the northern Gulf of Mexico

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A multi-year (2007-10) study was undertaken to determine meiofauna distribution patterns in the northern Gulf of Mexico, from 26 to 30°N latitude and -97 to -83°W longitude. Benthic sediment samples were taken using a Shipek® grab sampler and meiofauna sorted, identified (phylum or class) and enumerated. Temperature, salinity, dissolved oxygen concentration, latitude, longitude and depth were measured at each sample site. Sediment composition was also determined. A total of 1.3Ã—107 (indiv/m3) organisms were collected from 137 samples taken from 2007-2010. Individuals identified were Nematoda, Copepoda, Polychaeta, Kinorhyncha, Priapulida, Acari (mites), Tardigrada and Loricifera. Meiofauna distribution was influenced by sediment composition. Sand-rich samples contained slightly more meiofauna than samples with higher clay and silt, with sediment characteristics exhibiting longitudinal differences in the northern Gulf. Overall, meiofauna abundance was not affected by location, with only a slight increase of meiofauna collected in the sandy eastern stations. Thus, these results suggest that meiofauna and taxonomic composition are patchily distributed, evidenced by some areas of the northern Gulf being occupied by various taxa at higher densities, some at lower densities and some unoccupied.

148 A Reconnaissance of Mammalian Species Found in Oak Mountain State Park in Shelby County, Alabama

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David Frings

Oak Mountain State Park, located in Shelby County, Alabama, covers more than 9,000 acres of mixed habitat in the central portion of the state. Samford University, through the Oak Mountain Interpretive Center, began a study to determine the species in the class Mammalia that are present within the park boundaries in order to create a baseline for future wildlife conservation studies. A search of the literature indicated that there was a potential for fifty-five species of mammals to occur in the park. Four other species were known to have been extirpated from Alabama. Eighteen species in the orders Didelphimorphia, Cingulata, Rodentia, Lagomorpha, Soricomorpha, Chiroptera, Carnivora, and Cervidae were documented to be present in the park during this study. Several species of Carnivora were notably not

documented in the park while other species in the order were represented in large numbers. This may be due to the urban setting surrounding the park.

149 Seed germination and seedling survivorship of *Gentiana flavida* (Gentianaceae), an endangered species of Kentucky meadows and open woodlands.

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Gentiana flavida is an endangered species in Kentucky, with populations known from only five counties. Little is known about the life history of this species. The purpose of this project was to examine the initial stages of the species' life history: seed germination and seedling survivorship. Initial tests determined that the seeds are dormant at maturity. This study attempted to discover the necessary seed dormancy-breaking conditions and to determine the necessary growth medium for maximum seedling establishment. Mature seeds were placed in a 5° C incubator for varying time periods (0-12 weeks), simulating the cold stratification that seeds would receive in the field during winter, following autumn dispersal. Each treatment was moved to 25° C, 20°C, and 15°C incubators, respectively, and germination was monitored. To determine ideal growth medium conditions, seedlings were placed in four different soil treatments (mycorrhizal inoculated, non-mycorrhizal, field site, sterilized field site) and then monitored for survivorship over a 30 day period. Results indicated that the 12 week cold stratification treatment produced a significantly higher percent germination (74%) than stratification at 10 (68%), 8 (61%), 4 (8%), or 0 (0%) weeks at 25°C. Germination did occur at the lower temperatures (20°C and 15°C), but to significantly lower percentages. At the lower temperatures, only cold stratification of 12 and 10 weeks produced significant germination; however, no treatment produced better than 44% germination. Among the growth medium treatments, soil collected from the field site contained seedlings with the highest seedling survivorship (67%), significantly higher than the other three treatments. Potting media that contained mycorrhizal inoculants showed higher survivorship (38%) than media that was not inoculated (2%) and sterilized field site soil (0%). In conclusion, for maximum germination and juvenile survivorship, seeds should receive 12 weeks of cold stratification and have exposure to soil microbes for successful seedling establishment.

150 Blackwater Ecological Preserve: Longleaf Pine Inventory

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The Blackwater Ecological Preserve (BEP), a component of the Zuni Pine Barrens State Natural Area, is the northernmost extent of Pinus palustris' natural range. This preserve has two unique forest communities; Longleaf Pine Savanna and Longleaf Pine-Turkey Oak communities. Prescribed burning is a management practice supporting these communities' pyrophytic needs and has greatly increased the biodiversity at the BEP, which includes state-rare orchids. The BEP has several relics of the naval stores industry; the tar kilns and turpentine stumps here are believed to be the only remaining in Virginia, and are of historical interest the in Hampton Roads area. The site was surveyed in summer 2016 to assess the Pinus palustris population. Major factors considered were diameter at breast height (DBH), height, and spatial referencing data for each tree. Another set of data was collected to determine the relationship between DBH and age using a randomly generated subset of trees, which were cored at breast height. Each regression analysis was

done separately, and showed relationship between DBH, height, and age was highly variable; further work is necessary to determine why there is no apparent link between these factors. These data sets were also analyzed in R to test a hypothesized DBH/height relationship and in ArcGIS to create a population-density heat map. Plots were established to assess seedling survivorship after prescribed burning. Preliminary data showed strong DBH/height correlation among shorter and thinner trees, typically those <20m tall and <20cm DBH. This correlation is likely light competition driven as the correlation was stronger in stands of greater population density; this is speculative as density wasn't assessed for other tree species.

151 Ecological Limits to Local Species Richness in Dusky Salamanders (genus Desmognathus)

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Species richness commonly varies with elevation, but in many montane regions, the greatest number of species occurs at middle elevations. A recent regional analysis showed this pattern in Appalachian salamanders (genera *Plethodon* and *Desmognathus*). It has been hypothesized that phylogenetic niche conservatism in these salamanders results in species accumulating at intermediate elevations, which are characterized by the ancestral climate for the genus. The causal explanation is that physiological tolerances limit dispersal into higher or lower elevations. We tested this hypothesis using global information systems (GIS)-based analysis of 235 local *Desmognathus* communities. Consistent with the earlier regional analysis, local species richness was greatest at middle elevations. However, the number of species is not limited by physiological tolerances but appears to be restricted ecologically by climate variables favoring aridity and perhaps by biotic factors as well. Whether such ecological limits on species richness at the local level influences richness across regions or evolutionary clades remains to be tested.

152 Burrow Location, Daily Activity, and Temperature Patterns of the Gopher Tortoises, *Gopherus polyphemus*, on Cumberland Island, Georgia

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Due to habitat loss, urban sprawl, and overexploitation, the land-dwelling Gopher tortoise, *Gopherus polyphemus*, is now listed as a Threatened species in much of the southeastern United States. Gopher tortoises are considered a "keystone" species, mainly because the burrows they dig provide shelter for numerous other species as well the tortoises themselves. Therefore, any information regarding the current status, distribution, density, and impacts that may affect this species is critically important to the long term viability of the species. This information is particularly critical to the long term viability of remnant populations such as the previously unstudied population of Gopher tortoises on Cumberland Island, Georgia that has only anecdotal references to this population being found in history books written about the Island. The purpose of this study was to use "burrow" cameras, trapping, and remote game cameras to measure Gopher tortoise morphometric data and activity patterns, population size, and other animals burrow use on the 104 square kilometer Island. Additionally, data on burrow depth, dimensions, temperature, and GPS locations were documented and will be presented. Results of the study indicate that the Tortoises are concentrated in one area of the Island known as Stafford Field, which contained 259 burrows and 30.8% occupancy. Tortoises of all age classes were found, along with evidence of reproduction and

egg-laying. Unlike most other studies of other Gopher tortoise populations, the Gopher tortoises on Cumberland Island are most active during the highest mid-day temperatures. The population on Cumberland Island continues to be studied.

153 What's In A Name? Geographic Variability In Folk Knowledge Shapes Human Interactions With Eastern Hellbenders

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The Eastern Hellbender (*Cryptobranchus alleganiensis*), a large, aquatic salamander distributed primarily along and west of the Appalachian Mountains, has experienced dramatic declines across much of its range due to a host of interacting factors. Human-wildlife interactions loom large among these, as hellbenders occur in habitats that place them in areas frequented by anglers, boaters, and recreational swimmers. While it is known that many individuals, especially anglers, kill hellbenders when encountering them in the field, little work has been performed to understand how human perceptions shape attitudes towards hellbenders, especially perceptions related to colloquial knowledge in rural communities. We performed a survey of anglers (n = 280) at ten bait shops in seven rural southwest Virginia counties to examine these perceptions of hellbenders and their geographic variability. While anglers were generally supportive of hellbender conservation and behaviors associated with positive conservation outcomes, significant variation in hellbender perceptions existed across the two major watersheds in the region (Ohio River and Tennessee River headwaters). Ohio River Basin anglers were significantly less supportive of conservation programs and more likely to kill hellbenders than Tennessee River anglers - a difference not explained by prior familiarity with hellbenders or anglers' level of educational attainment. These differences were coincident with variation in colloquial names used for hellbenders across watersheds, suggesting an influence of folk knowledge on human perceptions and behaviors involving hellbenders across this region. Our results provide important context for designing amphibian education and outreach programs and stress the importance of acknowledging the influence of place in shaping conservation attitudes, especially in Appalachia and other rural regions.

154 SUBSTRATE SELECTION OF THE BONAIRE WHIPTAIL LIZARD (*CNEMIDOPHORUS MURINUS*)

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Ectothermic organisms are dependent upon environmental factors for regulation of internal body temperature due to the lack of ability to self-regulate temperature. To achieve optimal body temperature, ectotherms such as the endemic Bonaire whiptail lizard (*Cnemidophorus murinus*) bask upon many different substrates. This basking behavior involves dorsoventral flattening of the body to increase surface area and maximize heat absorption through conduction or convection. The effect of substrate type on body temperature regulation is crucial to understand as habitat loss of the endemic species is currently occurring due to infrastructure development on Bonaire, Municipality of the Netherlands. However, little research has been done to analyze substrate preference and efficiency of substrate among Bonaire whiptails. This study aims to gain an understanding of the importance of basking substrate effect of body temperature as well as basking substrate preference of the Bonaire whiptail lizard (*Cnemidophorus murinus*). Road survey methodology was used to search for lizards and obtain basking body temperature readings of the lizard with a compact IR thermometer, as well as the temperature of

the basking substrate. It was found that the Rock Like substrate allowed for marginal significance in in the alteration of basking temperature. Whiptails were found to significantly ($p<0.0001$) select for rock-like substrate over sand or vegetation for basking. This study demonstrates that thermoregulation is dependent upon many variables, not just substrate type. The island of Bonaire is undergoing development which is resulting in the direct loss of natural habitat of the whiptails. More research is necessary to determine the basking temperature altering abilities of the imported materials and vegetation.

155 Towards rectifying limitations on species delineation in dusky salamanders (*Desmognathus*: Plethodontidae): An ecoregion-drainage sampling grid reveals additional cryptic lineages

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Dusky salamanders (*Desmognathus*) constitute a large, species-rich group within the family Plethodontidae, and though their systematic relationships have been addressed extensively, most studies have centered on particular species complexes that offer only piecemeal phylogenetic perspective on the genus. Recent work has revealed *Desmognathus* to be far more lineage rich—35 independent evolutionary lineages versus 21 recognized species—than previously imagined, results that, in turn, provide impetus for additional survey effort within lineages and across geographic areas thus far sparsely sampled. We conceived and implemented a sampling regimen, one combining level IV ecoregions and independent river drainages, to yield a geographic grid for comprehensive recovery of all genealogically exclusive lineages. We sampled over 550 populations throughout the distribution of *Desmognathus* and generated mtDNA sequence data (1,991 bp) for 536 specimens. A Bayesian phylogenetic reconstruction of the resulting haplotypes revealed forty-five independent evolutionary lineages, eleven of which have never been included in a comprehensive phylogenetic reconstruction and an additional three not represented in any molecular systematic survey. Although general limitations associated with mtDNA data preclude new species delineation, we profile each of the 45 lineages and assign names to 10 new lineages (following protocol for previous lineage nomenclature). We also redefine several species complexes and erect new informal species complexes. Our dataset, which contains topotypic samples for all currently recognized species and most synonymies, will offer a robust framework for future efforts to delimit species within *Desmognathus*.

156 Succession in metacommunities: diversity-age relationships across trophic levels in pond ecosystems

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The metacommunity concept invokes the role of species dispersal among local communities in altering species diversity across hierarchical spatial scales. Although metacommunity theory can predict empirical patterns of diversity at local and regional scales, the role of succession in structuring diversity within metacommunities has largely been ignored. Temporal shifts in community composition within successional mosaics are likely to emerge from both local and regional processes. Here, we evaluated the importance of succession to multi-trophic metacommunity structure in a mosaic of different-aged ponds constructed by beaver in the Talladega National Forest, Alabama. We contrasted patterns of local and beta diversity in fish, zooplankton, and crayfish across temporal and spatial scales. Fish communities responded to pond age with a linear successional trajectory. Crayfish communities were strongly spatially-structured with no response

of diversity to pond age. Zooplankton exhibited a unimodal local diversity-age relationship and weak spatial structure. These unique taxonomic responses were driven by differential dispersal limitation and the local successional environment, where old ponds were deepest and supported less dissolved organic carbon. The results indicate that succession can structure metacommunities, but the importance of habitat age varies by taxonomic group.

157 Patterns of disassembly as coastal bottomland forest collapses with relative sea level rise

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Julie Denslow

Coastal forests in the Mississippi River Delta are undergoing major changes with rapid relative sea level rise. Increased hydroperiods limit regeneration and drive coastal forest retreat. Periodic but powerful tropical storms also influence forest dynamics. Differential regeneration and survival of species in response to these stressors and disturbances dictate patterns of community disassembly and reassembly. The objective of this study was to examine patterns of coastal floodplain forest change with rapid relative sea level rise. We asked the following questions: 1) What is the rate of forest disassembly? 2) Are species migrating upslope to drier conditions? 3) Do hurricane disturbances drive recruitment or accelerate forest demise? Our study site is located in the Jean Lafitte National Historical Park and Preserve, in Jefferson Parish, Louisiana. In 1998, we established a 5 hectare monitoring plot that spans an ~1m elevation gradient from the natural levee to the backswamp of Bayou des Familles. All trees ‰¥ 2.5 cm diameter at breast height were identified, mapped, and measured. Survival, growth, and new recruitment were quantified in subsequent plot surveys (2000-2015). Our results indicate that disassembly is rapid and densities of dominant species are steadily declining across the gradient, with the exception of *Taxodium distichum* (bald cypress), the most flood-tolerant species. Although tropical storms led to limited recruitment of some trees into larger size classes, they appear to largely accelerate forest disassembly. *Liquidambar styraciflua* (sweetgum) was the only species that exhibited regeneration upslope of mature individuals. Assemblages with the most flood-tolerant trees will persist for some time, but replacement communities in other areas are less certain. The most recent survey data revealed establishment of fresh marsh, herbaceous species at the wettest end of the gradient, which suggests the onset of conversion to marsh.

158 Ecosystem state change in a coastal system: mechanisms and consequences

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Coastal barrier systems naturally protect the mainland and may be among the most sensitive of all ecosystems to the effects of global climate change as ecological processes are closely coupled to both atmospheric and oceanic drivers. Large scale land cover change from grassland to shrubland has been documented at an unprecedented rate on barrier islands of the Virginia Coast Reserve (Long-Term Ecological Research site). These islands have lost upland area to sea-level rise. We quantified transitions between ecosystem states at the landscape scale and determined the effect of shrub encroachment on plant community and microclimate as related to physiology at the local scale. Over the past 30 years, Virginia barrier islands have experienced dramatic shifts in state: 34% loss of barrier island upland communities and 26% loss in back barrier marshes. During this timeframe, salt sensitive woody vegetation has increased by 40% due to atmospheric climate

change. The dominant expanding shrub, *Morella cerifera* displays unique physiological properties that have an immediate effect to condition the environment for further expansion while impacting species composition. These shrubs lower overall species composition, increase soil nutrients and moisture, moderate summer temperature, and increase winter temperature, all have ecosystem level consequences for stabilizing sediments, thus preventing barrier island migration in response to sea-level rise. State change in swales from grassland to shrubland shapes sediment dynamics associated with island migration by slowing down or blocking overwash as barrier islands erode and/or migrate in response to sea-level rise. Vegetation is an important functional component of coastal systems which affects geomorphological change by trapping sediment and promoting organic matter deposition, both of which are critical processes for shaping coastal landscapes. In this physically dominated ecosystem, the role of ecophysiology and biotic interactions are equally important and dynamic in shaping these landscapes.

159 Big picture conservation: Linking biodiversity, culture and conservation in the Mobile River basin

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A new 240-page report supported by Alabama universities and the National Park Service identifies the Greater Mobile-Tensaw River area in South Alabama as one of the most biologically and culturally significant regions of the country. By examining the larger landscape context, covering more than 3 million acres surrounding the Mobile-Tensaw Delta and the Alabama and Tombigbee rivers, the report reshapes concepts of biodiversity within the region, and explores how the region's distinctive geology, its extraordinary soil and topographic variability, and the connectivity between uplands and wetlands has contributed to the area's diversity and endemism. It also suggests that a large-context approach to conservation planning -- including cultural, historical and biological targets -- offers new opportunities to join federal, state and private partners in a mutually beneficial effort. We'll explore the findings of the report and discuss some of those emerging opportunities for preservation and conservation in the area. Forty researchers from multiple disciplines contributed to the report, which highlights the region's unusual geomorphology and landscape ecology. Active tectonics, resulting in the highest rate of land rise in the southeastern coastal plain, interacts with high-discharge rivers to promote surprising variation in topography, aspect, soils and hydrology. This may explain why, for example, the region appears to support the center of oak diversity in North America (north of Mexico), and why it harbors what is arguably the world's greatest concentration of turtle diversity. Because the riparian zone is the spine of biodiversity and cultural significance, multiple, discreet "gateways" of conservation and preservation can be established at appropriate sites over hundreds of miles, with the recognition that all efforts are connected to and by the rivers. This has important implications not only for capturing the region's most biologically diverse sites, but also for mitigating the impacts of climate change.

ASB POSTERS

P1 **Seasonal Changes in Maturation of Adult *Cotylaspis insignis* (Trematoda: Aspidogastridae) Recovered from the Fat Mucket, *Lampsilis radiata luteola* (Bivalvia: Unionidae).**

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Favour Akabogu, Robin Hauschner, Sandra Meneses, Olivia Slater, Kaitlyn Reasoner, Lin Peng, Chi Peng, Ron Rosen

The objective of this study was to assess seasonal changes in the maturation of young and mature adult *Cotylaspis insignis* recovered from the gill/visceral mass junction of the fat mucket, *Lampsilis radiata luteola*, over 12 months. Mussels were collected from North Elkhorn Creek, Scott County, Kentucky, U.S.A., between May 2015-July 2016. Staging of *C. insignis* (N = 675 worms) was based on the following criteria: Stage 1 = 17-18 peripheral alveoli in ventral sucker and 8 medial alveoli; Stage 2 = 19-20 peripheral alveoli in ventral sucker and 9 medial alveoli; Stage 3 = developing vitellaria present; Stage 4 = eggs present. Seasonal changes in the proportions of these stages were apparent in this study. Recruitment of a new cohort of adult worms by mussels began by December as evidenced by an increasing proportion of Stage 2 worms; this increase coincided with a steady decrease/loss of the older cohort of Stage 4 worms between November and March. By March and April, developing vitellaria (i.e., Stage 3 worms) became obvious in many *C. insignis*, and the majority of worms in this new cohort began to engage in egg production (Stage 4 worms) by late May/early June.

P2 **Variation in nickel concentrations among populations of the high-Ni insect *Melanotrichus boydi* (Hemiptera: Miridae)**

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Katherine Mincey, Paul Cobine, Robert Boyd

The Ni hyperaccumulator *Streptanthus polygaloides* (Brassicaceae) is an annual herb endemic to the California Sierra Nevada mountain range. It consists of four morphs: yellow (Y), purple (P), yellow/purple (Y/P), and undulate (U). These morphs vary in sepal color, morphology, and geographic location. This species hyperaccumulates Ni from the soil at concentrations that vary depending on the morph. The high-Ni specialist insect *Melanotrichus boydi* feeds on *S. polygaloides* via cellular disruption. This study compares Ni concentrations of *M. boydi* to other hemipterans collected from *S. polygaloides* plants. We also examined Ni concentrations of *M. boydi* to determine if insects collected from different host plant morphs varied significantly. We collected *M. boydi* specimens that were feeding on the four morphs of *S. polygaloides*. Additionally, non-Ni hemipterans were collected to compare their Ni concentrations to *M. boydi* from the same sites. We used Inductively Coupled Plasma Optical Emission Spectroscopy (ICP-OES) to analyze whole-body Ni concentrations of individual insects. Nickel concentrations of *M. boydi* (mean: 710 µg Ni/g) were significantly greater than those of other hemipterans (mean: 35 µg Ni/g). One-way ANOVA revealed that Ni concentrations of *M. boydi* differed depending on their host *S. polygaloides* morph. *M. boydi* from U morph plants had significantly greater Ni concentrations (1430 µg Ni/g) than *M. boydi* from P (450 µg Ni/g), Y/P (420 µg Ni/g) or Y (710 µg Ni/g) morphs, but those from other morphs did not significantly differ from each other. We conclude that *M. boydi* contains significantly more Ni than other hemipterans collected from *S. polygaloides*, confirming its status as a high-Ni insect species. In addition, concentrations of Ni in *M. boydi* differ due to

their morph host. Future studies will explore Ni concentrations in the different morph hosts to determine their correlation with Ni concentrations in *M. boydi*.

P3 Investigating the antimicrobial benefits of *Sanguinaria canadensis* on *Aphaenogaster* ants infected with *Beauveria bassiana*

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Chloe Lash

Myrmecochory (ant seed dispersal) is a widespread mutualism that has independently evolved multiple times. The benefits of myrmecochory to the myrmecochore (plant counterpart) are well known, yet benefits to the ant are not fully understood. Ants and plants are not isolated in this relationship, however, as they both extensively interact with microbes in their environments. Several species of ants secrete antimicrobial compounds via the metapleural gland to defend against microbial pathogens. Similarly, some plants contain antimicrobial compounds in their tissues. These antimicrobial defenses could influence one partner's relationships with their mutualism counterparts. Here, we investigate the potential antimicrobial benefits myrmecochores provide to ants within the myrmecochory mutualism by studying the interactions among *Aphaenogaster* ants, *Sanguinaria canadensis*, and *Beauveria bassiana*. We infected *A. rudis* and *A. picea* ant colonies with *Beauveria* at one of three dosages: high, low, or none and presented these colonies with one of three diets: *S. canadensis* seeds, standard insect protein food, or standard insect protein food with sanguinarine. We measured the number of dead ants, the degree of infection, and the egg production of each colony. As expected, uninfected colonies and low infected colonies had significantly higher survival rates than colonies infected at a high dosage. We found that the colonies fed a sanguinarine or insect protein diet also had significantly higher survival rates than the colonies fed a seed diet. However, there was no significant difference in infection level or egg counts across the three diets. These results suggest that sanguinarine may improve overall survival, although its benefit might not be merely antimicrobial. This also suggests that a fungal third party might be complicating what is normally assumed to be a simple pairwise mutualism.

P4 Microbial Interactions and Chemical Components within Myrmecochory

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Myrmecochory, is generally regarded as a simple pairwise mutualism in which ants gain a food source and plants gain dispersal. Microbes, including bacteria and fungi, are also abundant in soil environments experienced by ants and by seeds during the entire seed maturation and dispersal process (e.g. beneath parent plants, in fruits, within and outside of the ant nest). At least some of these microbes are pathogenic to plants or ants. However, ants and plants are not without defenses against these pathogens. Ants have antimicrobial glandular secretions and some plants also produce antimicrobial compounds. These antimicrobial compounds may provide the partners in myrmecochory with additional benefits. We hypothesize that in the process of dispersal, seeds might come into contact with ant glandular secretions, which might affect seed coat associated microbial growth and subsequently affect seed germination and growth. We also predict that ants, in the process of consuming the nutritive seed-coat-derived elaiosome, might be exposed to antimicrobial compounds that aid in the defense against entomopathogens. While a variety of studies will be conducted to understand the interaction of microbes in the myrmecochory mutualism, including fungal community composition, survival analysis, and germination studies, first we quantify and identify the chemicals in

metapleural glands of *Aphaenogaster* ants and look for the presence of these chemicals on ant handled seeds. Preliminary analysis indicates the presence of pentadecane, a compound with antimicrobial properties, in ant glandular secretions.

P5 Sippers and Blotters: Proboscis Morphology Can Help Determine Feeding Habits of Temperate Moths

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Ronald Hunsinger, Ethan Arnold

While the diet of many caterpillars is well documented, the feeding habits of most moths are unknown. Recent reviews have begun to compile lists of flower-visiting moths; however, less than 2% of the over 10,000 species of North American moths visit and pollinate plants, leaving the feeding habits of a large number of moths a mystery. While some species feed on nectar accessed via narrow corolla tubes, others may feed on open sources of liquid such as insect or plant secretions, puddles, or rotting fruit. Just as the beak morphology of birds is indicative of feeding mode, we reasoned that the feeding habits of moths might be related to proboscis morphology. Studies have shown that the proboscises of tropical butterflies differ based on whether they feed on fruit or flowers, but temperate moths have not been studied. We collected moths in Alabama and Tennessee using traps baited with either moth attracting flowers, floral extracts, or fermenting fruit. We examined the proboscis of each specimen for image analysis using light microscopy to determine if there were morphological differences between flower and fruit visitors. We expected that flower-visiting moths would have adaptations for drinking liquid through a narrow opening, such as a long proboscis with a short drinking region and few sensilla styloconica. In contrast, fruit feeders should have shorter proboscises with long and broad drinking regions ornamented with more sensilla styloconica. As expected, the 15 species attracted to flowers or floral extracts had fewer sensilla styloconica, shorter drinking regions, and less drinking region area overall than the nine species attracted to fruit. However, there was no difference in relative proboscis lengths. Our results indicate that morphological examination of moth proboscises may be helpful in preliminarily differentiating closed tube feeding species from those that feed on open sources.

P6 Time of Death: Using Insects to Develop a Postmortem Interval Estimate

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Forensic entomologists are often called upon to assist with law enforcement investigations. After 72 hours, insect evidence is the best method for determining the postmortem interval (PMI); the time elapsed from "death to discovery" . Here, I describe how the insects colonizing a human decedent were used to develop a PMI estimate for a homicide investigation. Using a dissecting microscope and dichotomous keys, it was determined that all specimens on the body were consistent with a single species, The Scuttle Fly, *Megaselia scalaris* Loew (Diptera: Phoridae). As the body was concealed, regression equations were developed to determine actual development temperatures for the insects on the body. On the basis of these temperatures, and previously determined rearing times for *M. scalaris*, the PMI was determined to be 8 days. In sum, insect development can be used as a "biological clock" providing key information in death investigations.

P7 Does infection with trematodes affect snail shell strength?

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Snails serve as a common intermediate host for trematode parasites. Trematodes are known to affect snails in many ways, including changing reproductive ability, shell shape, and behavior. In addition, infected snails sometimes prematurely divert resources, such as calcium, to egg production as an attempt to reproduce before succumbing to the parasite. As calcium is the main component of shells, we hypothesized that infection with trematodes negatively affects shell strength. Snail shells serve as a defense against crushing predators and therefore infection could potentially affect many aspects of snail fitness. We collected over 1500 Elimia sp. (E. carinifera and E. modesta) from Connesena Creek, near Kingston, GA. In the lab, snails were screened for infection and a sample of 60 infected E. carinifera and 39 infected E. modesta were selected for study. A corresponding number of uninfected snails from each species were then systematically chosen from similar collections. Sample snails were weighed, measured, and photographed. Shell strength was tested with a Mark-10 Force Gauge. Crushed shells were then dried to evaluate percent calcium using an ICP-MS analyzing machine. We found no difference in shell strength between infected snails and uninfected snails for either species. Other aspects of trematode infection, geomorphometrics and calcium content, are discussed.

P8 At the water's edge; Is parasite prevalence in snails higher at the edge of a stream?

Riccardo Fiorillo, Georgia Gwinnett College, School of Science and Technology, Lawrenceville, GA, 30043
Christopher Brown, Malachi Grover

P9 A topographical relationship between pollen grains and lepidopteran proboscises

Brandon Davis, Kent State University at Stark, Biological Sciences, North Canton, OH, 44720 Gabriella Laubacher, Matthew Lehnert

The topography of a surface (surface roughness) relates to self-cleaning and adhesion abilities. The mouthparts (proboscis) of butterflies and moths (Lepidoptera) expresse a range in surface roughness patterns that is species specific. Flower-visiting Lepidoptera rely on plant pollination for food sources and plants also rely on the pollinator transporting pollen for reproduction, which has led to some of the most classic examples of coevolution; however, studies of insect-plant pollination systems at a microscale are lacking. Here, we investigated the potential relationship of surface roughness patterns between pollen grains and lepidopteran proboscises. If surface roughness plays a role in pollen stickiness, natural selection would likely favor pollen to adhere to the proboscis textures of species that frequent that plant species as a nectar source. It was hypothesized that pollen grains of various topographies (e.g., smooth or spikey) might adhere better to particular proboscis surfaces for more efficient pollination. To test this, we performed a field study in Clinton, OH where all plant species that were in flower (n = 18) were collected for studies of pollen architecture and categorized according to topography. Moths were collected by light traps to determine 1) what moths were serving as pollinators, based on the presence of pollen on the proboscis, 2) and if pollen of specific topographies were adhered to particular proboscis surface roughness patterns. Our study indicates that surface roughness also plays a role in

the adherence of pollen grains to their respective insect pollinators and that proboscis topography does relate to pollen architecture.

P10 Parasite community structure of Redbreast sunfish, *Lepomis auritus*, in an urban watershed

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Ricky Fiorillo

We examined and compared the helminth parasite community structure of Redbreast sunfish, *Lepomis auritus* from Sope, Nickajack and Rottenwood Creeks in Cobb County, GA. All 3 streams are tributaries of the Chattahoochee River, flow through residential/commercial areas and experience varying levels of anthropogenic disturbance. The life cycle of many parasites of Redbreast sunfish, require multiple hosts, and are dependent on trophic interactions. Sunfish acquire these parasites by feeding on prey infected with parasitic larvae, or when parasites directly colonize fish through the skin. Parasites may be sensitive to environmental disturbance/degradation which disrupt trophic interactions. In October/November 2014, we collected Redbreast sunfish, then euthanized and stored them at -20 °C, within 2 hours of capture. We necropsied ~40 individuals per site and examined the gastrointestinal tract and visceral organs for helminth parasites. We report data on parasite species richness, abundance and compare the parasite community of this host among 3 localities.

P11 Regional distribution of pollen on lepidopteran proboscises

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Many species of butterflies and moths (Lepidoptera) visit flowers for nectar and subsequently play a role in pollination systems. Pollen transportation requires the adherence of pollen grains to the insects, and pollen has been observed to adhere to lepidopteran mouthparts (proboscis). Pollination is not only beneficial to the plant, but also to the pollinators for food sources. Pollination driven by pollen adhering to lepidopteran proboscises creates a paradox: how does the proboscis support pollination while maintaining optimal feeding abilities? We hypothesized that the proboscis has regions that allow pollen adherence without decreasing feeding abilities. We dusted the proboscises of four species of distantly-related Lepidoptera with pollen, then examined the distribution of pollen on the proboscis using scanning electron microscopy. We found greater pollen adherence to regions of the proboscis that would not impede the flow of fluids from liquid sources. Interestingly, these regions also are known to provide self-cleaning abilities. Our results provide evidence that pollen adherence is greatest near the knee-bend region of the proboscis, which might be a region that interacts with the flower anther during feeding.

P12 Central Appalachian Surface Mines: Paradise Lost or an Overlooked Hotspot for Green Salamanders?

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Candon Gardner, Eric White, Walter Smith, Bob VanGundy

The Green Salamander (*Aneides aeneus*) is a rare species of high conservation concern whose range overlaps with the central Appalachian coalfields. This species is a habitat specialist, preferring crevices in rock outcrops within mature, intact forests. Surface mining activities alter local topography and remove forest habitat,

and it is commonly assumed that historical mining activities have therefore eliminated many populations across the central Appalachians. However, little work has been performed to explicitly examine these habitat changes and the status of Green Salamanders on formerly-mined lands. We performed such a comparison in 2016 across a heavily-mined and previously unsurveyed portion of Wise County, Virginia. Forty-five rock outcrops were randomly chosen from undisturbed reference sites with known *A. aeneus* presence (n = 13) in the Jefferson National Forest, mined highwalls (n = 14), and remnant natural outcrops on former mines (n = 18). Crevice morphology, aspect, and slope were measured at each outcrop, along with forest characteristics within 100m2 of the rock face. An analysis of similarity (ANOSIM) found that habitat on remnant outcrops was statistically equivalent to that on undisturbed reference sites. We then related habitat variables to the presence of Green Salamanders, with the species found at 75% of remnant sites, at all reference sites, and at no mined highwalls. Contrary to assumptions about the impacts of surface mining on the persistence of Green Salamanders, we found that Green Salamander populations do in fact persist on many former surface mines as a result of remnant habitat on mine edges and within small, intact portions of native habitat within larger mine complexes. While promising from a conservation perspective, we do acknowledge that our results are restricted to the basic presence of salamander populations on former mines.

P13 Temperature preference of larvae of two cryptic, parapatrically distributed salamander species (*Eurycea wilderae* and *Eurycea cirrigera*) in a zone of sympatry

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Abiotic and biotic factors influence how species are distributed and whether different species occur sympatrically, allopatrically, or parapatrically. Abiotic factors such as environmental temperature and biotic factors such as competition can prevent similar species from living together and thereby result in mutually exclusive, parapatric ranges. Temperature may play an important role in the parapatric distribution of species when the contact zone occurs along an elevational gradient. At the southern end of the Appalachian Mountains, two similar salamander species displace one another geographically. The Blue Ridge Two-lined Salamander (*Eurycea wilderae*) and the Southern Two-lined Salamander (*E. cirrigera*) were once believed to belong to a single species (*E. bislineata*) until genetic research separated the two. *Eurycea wilderae* inhabits the Blue Ridge Mountains while *E. cirrigera* occurs in the Piedmont and Coastal Plain. In the Appalachian foothills they live together in a very narrow zone of sympatry. Within this zone they share the same habitat, but previous studies have shown that competition for food does not exist between the larvae of these salamanders. However, larval *E. wilderae* and *E. cirrigera* from allopatric populations have different temperature preferences and may have adapted to montane versus lowland environmental temperatures. We tested whether there is a difference in temperature preference in the larvae of these species within the zone of sympatry and found that there is none. Factors affecting the adults rather than the larvae may be the responsible factors maintaining the parapatric border between these species.

P14 An Ethogram for the Central Bearded Dragon, *Pogona vitticeps*

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In this study, an ethogram was developed for the Central Bearded Dragon (Pogona vitticeps) with an interest placed on the expression of "beard" colouration. The lizards were placed into one of 3 behavioural trials, and their behaviours were recorded using a video camera and direct observation. Colour expression was recorded using a digital camera and a spectrophotometer before and after each trial. Also recorded was the mass and SVL of the participants. The 3 trials were solitary, intrasex interactions, and intersex interactions. Forty-four behaviours have been recorded and defined by mechanism and use. The behaviours were then analysed by interaction type and context so that they could be placed into 8 categories. The purposes of some behaviours such as gular-expansion were hypothesised upon but a distinct purpose was inconclusive. Some behaviours such as colour expression, and head bobbing, seem to have different uses depending on the context in which it was displayed. Also noted was that some behaviours, like push ups, elicited predictable almost ritualised responses from the receiver, which depended on the sex and size of the participants. Colour expression was used primarily in association with other social, aggressive, or courtship behaviours, and seemed to enhance the behaviour. It was also primarily seen in male lizards. More work will be needed to see if wavelengths are associated with certain behaviours.

P15 A test of the functional significance of red ventral color in fossorial snakes (*Storeria*)

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Barry Stephenson

In North American snakes, bright red coloration of the dorsal scales is often linked to aposematism, as in coral snakes and their nonvenomous mimics. Many other snakes (especially small, fossorial species) exhibit bright red or pink color on the ventral surface, in contrast to a brown or gray dorsal color. The possible significance of red ventral coloration is unclear for most species, given secretive habits, lack of documented tail display behaviors, or both. Nevertheless, one possibility is that red ventral color can also serve to deter attacks on snakes from avian predators, perhaps after rolling onto their backs. In central Georgia, the red-bellied snake (Storeria occipitomaculata) is sympatric with the closely related brown snake (S. dekayi). Red-bellied snakes have a bright red venter and a brown or gray dorsum; brown snakes have a similar dorsal color, but express white or cream ventral coloration. To test the hypothesis that red ventral color serves to deter predation, we will build 600 plasticine model snakes resembling each of these two species presented in two different positions, for a total of 150 models/treatment. In each model, dorsal color will be held constant (gray), but ventral color will differ (red or white); in addition, half the models will be oriented upside down, providing an opportunity for predators to observe the ventral color. Models will be placed in the field in April 2017, then collected to score for evidence of bird attack. If the red venter of a red-bellied snake acts to exploit a general avoidance response by birds to red stimuli, we expect that models presented to predators with an exposed red venter will exhibit lower rates of attack than models presented with the white venter exposed, or any ventral color treatment model presented dorsally.

P16 Using video manipulation and video playback to study the influence of color on communication in geckos

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Body color and color patterns are fundamental in prey escape mechanisms, thermoregulation mate selection, and intra- and inter-specific communication. Among the various functions, color and color patterns have been observed to be used for individual recognition. Among lizards, geckos vary greatly in color and color pattern. To address the question of the influence of color for individual communication in this group, we will compare gecko behavior in the context of direct individual interaction and playback videos that have been edited using MATLAB. Direct individual interaction will provide a baseline of behaviors occurring during individual encounters with the same or opposite species and the same or opposite sex. In the video manipulations for playback videos, we will change separately saturation, hue and brightness of the color of the gecko or of the background. Saturation, hue, and brightness of the videos (geckos and background) are manipulated independently to uncover the influence that each of these aspects of coloration has on individual recognition in geckos. This approach allows collecting data 1) to assess if individual recognition occurs in geckos; 2) on the type and frequency individual behavioral displays shown during individual recognition; and 3) to discriminate which component of color, color pattern or background color influence individual recognition in geckos. Although playback experiments are common in animal behavior studies, our approach is unique in that we will be using video streaming to isolate which aspect of coloration and color patterns stimulate a response. Our experimental approach has been designed to allow us to exclude acoustic and chemical signals, which are considered important in gecko communication. This experiment will set a baseline for future studies on sexual selection and trait evolution in geckos and closely related species and begin to explain the coloration in such a diverse radiation of lizards.

P17 Reproductive Ecology of a Freshwater Turtle Community at Reelfoot Lake, Tennessee

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Field surveys were conducted at Reelfoot Lake from April 1993 to September 1995 to assess species richness and reproductive ecology of a freshwater turtle community. Turtles were captured using baited nets or by hand. Morphological measurements (i.e., carapace length, plastron length, and shell height) were measured straight-line to the nearest 0.1 mm using dial calipers. Turtles were weighed using Pesola spring scales to the nearest 2g when possible. All turtles were marked by notching the marginal scutes with a small file. In addition to examining turtles for the presence of eggs as determined by palpation or radiography, turtles were sexed using secondary sex characteristics. Sex ratios were typically male biased for each dominant species at the two sampling localities (i.e., Upper Blue Basin, and Kiwanis Slough); but, sex ratios for *Trachemys scripta* were largely female biased at Upper Blue Basin. A total of 1036 turtles were palpated and radiographed, and represented three dominant species (471 *Chrysemys picta*, 151 *Sternotherus odoratus*, and 414 *Trachemys scripta*); and, where the smallest gravid female was 104.0 mm, 56.9 mm, & 173 mm, respectively. Average clutch size for the three dominant species was 5.95 (range 3-9; SD+-1.33) *Chrysemys picta*, 3.62 (range 1-6; SD+- 1.16) *Sternotherus odoratus*, and 11.77 (range 2-25; SD+- 4.79) *Trachemys scripta*. Egg production and subsequent nesting in these species was greatest from mid-May to early June. Our findings were congruent with other studies focusing on the reproductive ecology of freshwater turtles in the southeastern United States. In closing, we recommend that the take of turtles in Tennessee be closed or restricted, and if take is allowed,

then it must be closely monitored and regulated through a government agency (e.g., Tennessee Wildlife Resource Agency, TWRA).

P18 Flight initiation distance in green and brown anoles

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E. Natasha Vanderhoff

Invasive species often outcompete and displace native species and this may be due in part to different behavioral syndromes of native and nonnative species. The green anole *Anolis carolinensis* is a small terrestrial lizard native to the Southeastern United States. The brown anole *Anolis sagrei* is an invasive lizard introduced from Cuba in the late 1800's that has since spread through much of the southeast. As the brown anole has spread, the green anole has been displaced, becoming more arboreal. Due to this displacement and the more aggressive nature of the brown anole, it is thought that brown anoles may be less cautious than green anoles. To test whether brown anoles are less cautious we compared alert distance and flight initiation distance (FID) in brown and green anoles on the campus of Jacksonville University in Jacksonville, Florida. Green anoles had higher alert distances and FIDs; however, these differences were not significant.

19 Egg and Hatchling Size from Two Populations of *Gopherus polyphemus* in Southeastern Georgia: Effects of Habitat Quality

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The influence of habitat quality on female size, egg size and hatchling size has received limited attention in tortoises. This region of study is of utmost importance in the conservation of chelonians because of the vulnerability of subadults of these species to predation. This study examines the difference between the size of the eggs and hatchlings from two populations of gopher tortoise in southeastern Georgia. The study sites are George L. Smith state park and the Fort Stewart Army Reserve. Both sites contain sandhill habitats dominated by longleaf pine and wiregrass. These sites have varying management plans in relation to prescribed burns, with the entirety of the Fort Stewart Army Reserve being burnt biennially and George L. Smith state park being burnt irregularly, with the last burn occurring in 2014. Female tortoises from each site were captured and measured, then taken to Georgia Southern where they were radiographed to determine gravidity and clutch size. They were released at the point of their capture within 24 hours. Nests were located and predator-proofed with vinyl coated wire mesh grates during the incubation season from late May to early July and eggs were retrieved from those nests on August 19th (Fort Stewart) and August 21st (George L. Smith) to complete incubation in the lab at 28.5C until hatch. Ten nests were retrieved from Fort Stewart, while five nests were retrieved from George L. Smith. The eggs from each site are compared first to each other, then to a historical data set covering the past 20 years in order to determine if controlled burns have an effect on egg and hatchling size and weight. The study found that hatchlings from Fort Stewart were initially larger than those from George L. Smith, however parity of average weight was achieved within two months.

P20 Assessment of land development in the Range of *Pseudemys alabamensis* (Alabama red-bellied turtle)

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Turtles are among the organisms in the Southeastern US in greatest need of assessment, as Alabama is within one of the three global turtle priority areas for conservation and has high turtle biodiversity. *Pseudemys alabamensis* (Alabama red-bellied turtle) is an endemic species that occurs only in the lower drainage systems of Alabama and Mississippi, with the Mobile Tensaw delta being the northern limit of its range. It is classified as endangered by the U.S. Fish and Wildlife Service and has been placed on the IUCN Red List. The range for this species is narrow around Mobile Bay, Alabama, which is heavily urbanized and prone to large amounts of chemical runoff. Some chemicals that may be found in runoff have the potential to be genotoxic. Chemical runoff from agricultural fields has been shown to be harmful to amphibians and reptiles in ovo exposure, including increased levels of DNA damage, which may cause cancers and birth malformations. In this work, we used ARC GIS to identify watershed habitats of *P. alabamensis* that are heavily developed (high levels of urbanization and agriculture). The U.S. EPA Toxic Release Inventory was then used to identify industrial sites around the known habitat of this species and potentially toxic chemicals used at these sites. Of all the sites, Dog River watershed was the most developed with 61% (36124.78 acres) of its land usage being defined as developed. Toxic compounds that may be found at industrial and agricultural sites in the area include hydrazine, polycyclic aromatic hydrocarbon compounds, heavy metals, atrazine, trifluraline, and glyphosate. Future directions of this study include assessment of DNA damage in *P. alabamensis* at the studied sites. The results of this work will permit the development of management strategies and effective conservation actions, such as identifying areas that would require habitat restoration.

P21 Clutch and Sex Effects on Growth Rates in Gopher tortoise, *Gopherus polyphemus*, Hatchlings

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Incubation temperatures have an effect on the sex and size of hatchling turtles, tortoises and other reptiles. They have also shown to have an effect on hatchling survival and size after 120 days of hatching as well as post hatching performance. This study is being conducted to look at gopher tortoise hatchling growth rates within and among different clutches. Nests and hatchlings were collected from George L. Smith State Park and Fort Stewart Army Reserve in southeast Georgia during August of 2015. Nest temperatures were recorded throughout incubation in the field. Sex was determined using laparoscopy. Nests were not separated in order to determine if there was a clutch effect on growth rate. Growth rates will be reported using straight carapace length (SCL) and mass. Hatching success was ~81% for Fort Stewart, ~94% for George L. Smith, and ~86% overall. Growth data will be compared with sex and clutch. Having this data will give us insight to continued management of gopher tortoise populations as climate change and other environmental changes can affect nest temperatures. This can also give us insight on how to improve management for this species as it is a keystone species in its habitat.

P22 Testing the importance of tail color to prey attraction in caudal-luring copperheads (*Agkistrodon contortrix*)

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Caudal luring is a form of aggressive mimicry employed as a foraging strategy by many species of snakes, especially vipers (Viperidae). This strategy is most commonly observed in juveniles, and typically incorporates both distinctive movements of the tail and a colorful tail tip, generating a stimulus that resembles both the body form and movement patterns of certain invertebrates consumed by the prey of luring snakes. Existing work indicates that tail movements are highly effective at attracting certain visually-oriented prey of caudal luring snakes; however, the significance of tail color per se to caudal luring success is unknown. Copperheads (*Agkistrodon contortrix*) have been reported to display caudal luring behavior as juveniles, and exhibit a conspicuous bright yellow tail tip during this period; adult copperheads generally do not caudal lure, and lack the bright yellow tail tip of juveniles. If yellow tail tip color is an adaptation that serves to increase the effectiveness of caudal luring in copperheads, we expected that yellow tails would be more effective at attracting prey than non-yellow alternatives. To test this hypothesis, we designed a robotic 'snake tail' designed to mimic the general form of the tail of a juvenile copperhead, and the associated caudal luring movement patterns. In a repeated-measures design, we exposed wild-caught green frogs (*Lithobates clamitans*), a known prey species of copperheads, to the robotic tail under each of three tail treatments (yellow, green, and brown) during videotaped trials. In no trial was a frog observed to bite the tail, though ongoing statistical analysis will test for more subtle evidence of discrimination by the frogs on the basis of tail color. Forthcoming research using another copperhead prey species (fence lizards: *Sceloporus*) should provide insights as to whether yellow tail tip color acts as key stimulus for only some prey types but not others.

P23 Abundance of earthworms under nitrogen-fixing and non-nitrogen-fixing plants

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Plant communities affect soil chemistry, which in turn affects organisms within the soil. Soil-inhabiting organisms such as earthworms, which play a very important role in decomposition and nutrient cycling, may be encouraged or inhibited in their contributions to the ecosystem by the types of plants growing in the soil. This study, conducted in North Carolina, investigated the abundance of earthworms in the soil under plants that fix nitrogen and under those that don't. It was hypothesized that more earthworms would be in the soil under nitrogen-fixing plants than would be under non-nitrogen-fixing plants because the earthworms would be attracted to the more nutrient-rich plant matter of the nitrogen-fixers. We assessed earthworm abundances and lengths in the soil underneath 3 plants each of 3 N-fixing species and 3 non-N-fixing species. Under the N-fixing plants, there were significantly greater numbers of earthworms and the worms were longer than those found in the soil under the non-N-fixing plants. Our results suggest that more rapid nutrient cycling may occur under nitrogen-fixing plants than under non-nitrogen fixing plants.

P24 Shrub expansion leads to biotic and abiotic changes in coastal grassland ecosystems

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Barrier islands, which protect dense populations and areas of economic importance along the coast, are significantly impacted by factors associated with climate change. Although the Virginia barrier islands have lost significant surface area due to sea level rise, *Morella cerifera* thicket area has increased, encroaching into historic grassland. This native, evergreen shrub exhibits highly productive

physiology and has an association with nitrogen-fixing *Frankia*. Our objective was to quantify changes in the local microclimate and biotic composition associated with shrub expansion. We hypothesized that expansion of *M. cerifera* would moderate microclimatic temperatures and increase depth to the water table, but reduce species composition. To determine effects of shrub establishment on microclimate, and feedbacks onto further shrub expansion, species composition, leaf-area index (LAI), ground temperature, air temperature, and water table depth were recorded across three landscape types: grassland, transition plots, and shrub thicket plots. The grassland exhibited significantly lower winter temperatures and higher temperatures in summer, likely because of the increased LAI associated with shrub establishment. The temperature range within shrub plots was greatly reduced in comparison to grass-dominated plots. *Morella cerifera* shrubs benefit from this moderated temperature range, which is closer to the photosynthetic temperature optimum, ~30 oC. Depth to the freshwater lens was increased in the shrub and transitional plots compared to grassland plots. Lower water table and high LAI serves to decrease the persistence of grasses and further facilitates establishment of shrubs and expansion of the thicket. Feedbacks between shrub establishment and microclimate could have impacts on resilience of the island ecosystem to sea level rise and climate change-associated increased storm frequency and intensity.

P25 Effect of nest proximity on individual level behaviors during competitive interactions between *Aphaenogaster carolinensis* and *Nylanderia faisonensis*

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Prior investigation has found that the presence of *Aphaenogaster carolinensis* Wheeler nests has an effect on *Nylanderia faisonensis* Forel colony recruitment to a food source. The purpose of our research was to determine if the proximity of either species' nest can affect individual-level behaviors of these ant species. To do this, we collected video data in mesic forest around Piedmont College and at a similar location in Hall County, GA. We used Pecan Sandies crumbs as bait and observed the interactions of the target species. Any behavioral change in response to an interaction observed in either species was considered a high intensity response. We used Chi-square analyisis to determine whether the frequency of high intensity responses by either species at locations with nests was different from expected. All but a few interactions resulted in *N. faisonensis* changing its behavior, with and without nest in close proximity, while *A. carolinensis* was much less likely to do so. There was, however, no detected influence of proximity of either species nests on the behavior of individuals of either species.

P26 Isolating the distinct nest site preferences of two regularly co-occurring ant species, *Aphaenogaster carolineneis* and *Nylanderia faisonensis*

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Aphaenogaster carolinensis Wheeler and *Nylanderia faisonensis* Forel are common ground foraging forest ant species that are frequently found together in the southeastern United States. The purpose of this project was to isolate the differences in their nest site preferences that allow them to coexist regularly. Twenty 0.363 meter areas within a forest in Habersham County Georgia were searched for nests of these two species. Also collected from those areas were sets of information on above surface and below surface characteristics of the environment. Above surface characteristics included canopy cover, slope, aspect, tree basal area (within

2.0 meters) and cover of ground vegetation. Below surface characteristics included organic layer depth, and the occurrence and dimensions of objects (such as rocks and woody stems) projecting from the organic and mineral layers. Two Multiple Response Permutation Procedures (MRPP) were used to test for non-random relationships between habitat characteristics and nest occurrence for each species (one for above surface factors and one for below surface factors). Upon occurrence, nest depth (organic layer or mineral layer) was also noted. There was a significant relationship between N. faisonensis nest occurrence and above surface characteristics. The relationship between their nest occurrence and below surface characteristics was not different from random. Neither set of characteristics had a significant relationship with *A. carolinensis* nest occurrence. *Nylanderia faisonensis* nests were more likely to occur in the organic layer than in the mineral layer.

P27 Barnacle colonization on *Spartina* *alterniflora* in Georgia salt marshes

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Spartina *alterniflora*, the dominant plant species of Atlantic salt marshes, plays an integral role in salt marsh development and maintenance. Therefore, coastal management strategies aimed at salt marsh conservation include techniques to maintain *S. alterniflora* populations and promote plant growth. There have been reports of barnacle colonization on the stem and leaves of *S. alterniflora* within several Georgia salt marsh systems. Although this is not the first record of barnacle colonization on salt marsh plants, little research has focused on factors influencing plant susceptibility to colonization or the effect of colonization on plant productivity. The purpose of this study was to determine if there were spatial and/or temporal patterns in barnacle colonization on *S. alterniflora* in Georgia. Specifically, the barnacle density was assessed on twenty individuals along a 20-m transect at different times during the growing season (June, July, and August) and within three salt marshes of varying marine influence: (1) marsh adjacent to a boat ramp on the Skidaway River (SRBP; marsh located in the interior portion of a coastal river), (2) fringe marsh along the mouth of the South Channel Savannah River (SCSR; marsh within the river-ocean interface), and (3) marsh bordering the northern end of the beach on Tybee Island (NETI; marsh within the estuarine habitat of a barrier island). Results showed that individuals in the NETI marsh had a significantly greater density of barnacles on stems and leaves compared to SRBP and SCSR marshes. Additionally, the number of barnacles on stems significantly increased from June to August, while the number of barnacles on leaves significantly decreased. These results suggest that salt marsh location within the coastal system influences the susceptibility of *S. alterniflora* individuals to barnacle colonization and the timing during the growing season effects the part of the plant susceptible to colonization.

P28 Classification of the Piedmont "prairie" community complex

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The concept of the Piedmont "prairie" encompasses a complex of heterogeneous communities generally characterized by a semi-open canopy with a prairie-affinity forb and graminoid understory. Many rare species of state and federal concern are associated with the Piedmont "prairie" concept such as *Echinacea laevigata,* *Helianthus schweinitzii,* and *Silphium terebinthinaceum.* These communities require periodic disturbance and quickly degrade when historical disturbance patterns are disrupted, such as under fire suppression. The classification of these

communities is challenging as few high-quality examples of Piedmont "prairies" remain and many sites have degraded beyond recognition, resulting in a loss of the diverse herbaceous understory following the development of a closed-canopy. Using a dataset of over 2000 Piedmont plot records extracted from the Carolina Vegetation Survey database, we seek to explore the Piedmont "prairie" concept in the context of the current landscape as well as circumscribe these communities to better fit within the US National Vegetation Classification (USNVC) framework. We used hierarchical cluster analysis and fuzzy clustering to quantitatively identify subsets of these plots that best fit within the USNVC hierarchy. Non metric multidimensional scaling was used to ordinate the plots and explore possible structure of the landscape. Ongoing analyses include determination of diagnostic species and exploration of environmental factors influencing the structure of the Piedmont landscape and the occurrence and persistence of Piedmont "prairie" communities. We are also interested in identifying signals for distinguishing potentially degraded Piedmont "prairie" communities from other Piedmont forest communities.

P29 The relationships between breeding bird assemblages, vegetation structure and arthropod assemblages at the Lillian E. Smith Center, Rabun County, Georgia.

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Corbet McClung, Kenneth Mcleod, Timothy Menzel

Previous studies of songbird populations have found strong relationships between their breeding success, arthropod abundance and vegetation structure. The purpose of this project was to test for community level responses by birds to arthropod assemblage and vegetation structure at the Lillian E. Smith Center in Rabun County, Georgia. Our questions included: 1) Is there a relationship between breeding bird assemblage and vegetation structure? 2) Is there a relationship between breeding bird assemblage and arthropod assemblage? 3) is there a relationship between arthropod assemblage and vegetation structure? We were also interested in the relationship between vegetation, arthropods and the occurrence of two songbird species, Ovenbird (*Seiurus aurocapilla*) and Hooded Warbler (*Setophaga citrina*). Breeding bird point surveys were conducted at ten locations over a one week period in June of 2016. Arthropods were collected from an array of four pitfall traps at each location during the same time period. Vertical vegetation structure and canopy cover were quantified over those same areas. Mantel tests were used to detect non-random relationships between vegetation structure, arthropod assemblage and bird assemblage. Multiple Response Permutation Procedures (MRPP) were used to detect non-random relationships between arthropod assemblage, vegetation structure, and the occurrences of ovenbirds and hooded warblers. Non-random relationships were found between breeding bird assemblage and vegetation structure, hooded-warbler occurrence and vegetation structure, and ovenbird occurrence and arthropod assemblage, with all other relationships being no different from random. Hooded warbler occurrence was associated with higher levels of vertical vegetation structure. Ovenbird occurrence was associated with occurrence of orthopterans (crickets).

P30 Patterns of fruiting phenology and seed predation in native and invasive plants

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While it is well-known that the seeds of many invasive plant species are disseminated by birds, the fate of those seeds once they are dispersed has not

often been documented. In this study we determined the timing of fruit availability of a selection of native and non-native plants in central Georgia and then compared predation rates of seeds on the forest floor. Phenology of fruit availability of the native Southern magnolia (*Magnolia grandiflora*) and the invasive Chinese privet (*Ligustrum sinense*) and tallowtree (*Sapium sebiferum*) was quantified by marking fruit-bearing branches and then counting fruits in weekly censuses. Seed predation trials were conducted in the Wesleyan College Arboretum for all pairwise combinations of magnolia, privet, tallowtree, pokeweed (*Phytolacca americana*), blackgum (*Nyssa sylvatica*), and Nandina (*Nandina domestica*). Ten seeds each of two species were placed in 45 two-part divided trays made of aluminum mesh and trays were placed every 3m along 4 parallel transects through oak-pine-hickory forest. The order of treatments along transects was determined by random numbers. Seed removal rates were monitored for 20 days and then the experiment was repeated for a second 20-day period. The fleshy seeds of Southern magnolia were available to frugivorous birds from late August to late October, while fruits of both tallowtree and Chinese privet were presented in fall-winter. Results from the seed predation study will be presented and their relevance for understanding invasion by non-native plants will be discussed.

P31 Plant/Grasshopper Food Webs in Prairies and Longleaf Pine Savannas Using DNA Barcoding

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Determining the diets of mobile or wary animals has proven to be challenging for ecologists. In this project, we are using DNA barcoding to develop food webs for grasshoppers and their host plants from two southeastern habitats, blackland prairies and longleaf pine savannas. Barcode libraries have been created for plants from both habitats. For blackland prairies, we have sequenced two gene regions, rbcL and matK, for 140 plant species collected in Mississippi and Alabama. For longleaf pine savannas, we have sequenced the rbcL gene region for 95 plant species collected from southern Georgia. To determine grasshopper diets, we caught grasshoppers in the field, held them until they defecated and then released them. Plant DNA was then extracted from these samples, amplified using PCR for the rbcL gene region and then sequenced. Sequences were edited and then compared to the appropriate DNA barcode library, or when no clear match was present, to GenBank. High quality DNA sequences were obtained from 114 grasshopper samples (from 24 grasshopper species), including 103 from prairies and 11 from longleaf pine savannas. Of these 88 (77%) contained 0 to 2 ambiguous bases. The remainder had larger numbers of ambiguous bases, suggesting that they contained DNA from more than one plant species. Seventy-two samples perfectly matched plant barcodes in one of the libraries. The remaining 16 were likely for plants not included in the barcode libraries. Five of the 11 samples from longleaf pine savanna could not be confidently assigned to species, presumably because the library for the habitat is not close to completion. Andropogon glomeratus (bushy bluestem) was found in the diet of seven prairie grasshopper species, the most of any plant species. Overall, we have found that DNA barcoding is a valuable complement to fieldwork in determining the diets of insect herbivores.

P32 Foraging ecology of a southeastern bird community

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Avian communities are shaped by a variety of factors. Food, nest sites, predation, territoriality, and competition all play important roles in determining community

structure (Greenberg and Grdwohl 1986, LaManna et. al. 2015). Migratory birds travel between wintering grounds and summer breeding grounds to exploit seasonal abundances in prey species. These migrants have to quickly locate foraging sites while minimizing negative heterospecific interactions. While resident birds do not have to deal with the stress of exploring novel habitat, they do have to respond to seasonal changes in community structure and competition as migrants pass through or reside seasonally (Lewke 1982, Johnson and Sherry 2001). Migrant-resident interactions could be explained by one of four hypotheses: 1. Migrants occupy open niches that were not used by residents, 2. Niches are filled and migrants displace residents through competitive exclusion, 3. Niches are filled and migrants partition resources with residents, and 4. Migrants utilize a broader range of resources, allowing them to fill any open niches or compete with residents depending on resource availability. To test these hypotheses, an observational study will be conducted to address resource competition by comparing foraging behavior of residents with varying levels of migrant presence. This study will take place at Magnolia Springs State Park in Millen, Georgia. Park trails will be walked and searched for birds. Sampled individuals will be observed for as long as possible and the following parameters will be recorded: type of foraging behavior, perch height, plant species used, part of plant used, estimated percent canopy cover, and weather conditions (percent cloud cover, precipitation, wind speed, temperature). Behavior of residents will be compared before and after the departure of winter migrants.

P33 Does forest diversity drive predation rates?

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Of the many projected effects of global climate change, the alteration of trophic interactions will be one of the most influential factors in determining future ecosystem health. This can been seen in the relationship between plants, insect herbivores, and their predators. Climate change is expected to allow insects to expand outside their historic ranges and milder winters will allow pests to proliferate. Without sufficient controls on populations, insect pest outbreaks can cause widespread damage and mortality in forested ecosystems. According to the enemies hypothesis, habitat diversity may naturally protect plant communities from excess herbivore pests damage through top-down control by predators such as arthropods, birds, and mammals. We used artificial caterpillar larvae to examine the effect of tree species diversity on predation rates of insect herbivores in an existing forest diversity experiment in Edgewater, Maryland. Artificial caterpillars were installed on selected trees within plots containing one, four, and twelve tree species and checked regularly for signs of predator damage. Overall, plot-level tree diversity did not have an effect on caterpillar predation rates. Instead, species-specific impacts were seen as caterpillars on sycamores (*Platanus occidentalis*) were attacked more frequently. Additionally, caterpillars on taller trees had a higher attack rate, likely because greater canopy cover provided better foraging habitat for predators. This study indicates that, after three years of restoration, forest diversity is not the most important driver of predation on insect herbivores but rather, faster growing trees, that more quickly establish canopy cover, attract more predators and should therefore be utilized in forest restoration.

P34 Species-specific mechanisms contributing to the mesophication of upland oak stands

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Upland oak forests of the eastern United States are shifting towards being dominated by shade-tolerant, fire-intolerant species, which can be attributed to fire suppression. This shift has been hypothesized to lead to mesophication, a process where shade-tolerant, fire-intolerant species create a cool, moist understory, thereby reducing fuel flammability and promoting their own proliferation at the expense of upland oaks. To date, there have been few empirical studies identifying mechanisms used by trees to promote mesophication, and these studies have yet to extensively explore potential mesophytes outside of the 'super generalist' red maple (*Acer rubrum*). To address this issue, I sampled four hypothesized mesophytes (*A. rubrum*, *A. saccharum*, *Carya ovalis*, and *Fagus grandifolia*) and two upland oak species (*Quercus alba* and *Q. montana*) across a gradient of sizes (20-60 cm) in western Kentucky. I quantified canopy area, bark roughness and thickness, and leaf litter traits that may lead to differences in forest floor flammability among upland oaks and mesophytes. Ultimately, these traits will be compared to differences in fuel moisture and loads underneath these species to aid in predicting the pathway used by mesophytes to become dominant in upland oak forests. Preliminary results show that mesophytes have thinner and smoother bark than upland oaks, which could contribute to greater stemflow funneling by these species. However, canopy area was similar among species. Delineating the potential mechanisms by which mesophytes could alter forest flammability through their bark, canopy, and leaf litter traits is essential for understanding future forest function and exploring options on how to successfully manage for preservation of upland oak forests.

P35 Resilience of gallberry (*Ilex glabra*) to prescribed fire in longleaf pine (*Pinus palustris*) forests.

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Brandy Purdy, Courtney Filliben, Micheal Davis

Prescribed fire is often used to maintain and restore longleaf pine forest understories. A frequent problem in longleaf pine systems is the persistence of gallberry (*Ilex glabra*), a native shrub that forms large patches that can exclude more desirable vegetation. This study examined the resilience of gallberry density to prescribed fire. The study occurred in an uneven-aged longleaf pine stand established after a clear-cut in 1916 near Hattiesburg, MS. Stand restoration efforts began in 2009, and prescribed fire was reintroduced after a 25 year absence. Fire now occurs every other year in this stand. In 2016, gallberry stem density and maximum height was recorded in 40 2 m2 plots. In September 2016, prescribed fire was applied. Two months after the fire, stem diameter and number of new-growth sprouts per individual stem were recorded. Regression models were calculated for each of the following combinations: 1. Pre-fire stem density vs. Post-fire stem density; 2. Pre-fire maximum stem height vs the average number of new sprouts per individual stem; 3. Pre-fire stem density vs the average number of new sprouts per individual stem; 4. Stem diameter vs the number of new sprouts per stem; 5. Pre-fire stem density vs stem diameter. Overall pre-fire stem density had no effect on post fire stem density. Likewise, pre-fire stem density and maximum height had no effect on stem diameter or number of post-fire sprouts per stem. Stem diameter, however, was strongly correlated with the number of post fire sprouts. These data indicate that gallberry plants with larger stems are more likely to be more resilient to prescribed fire and thus more difficult to eradicate.

P36 Temporal And Age Distributions Of White-Tailed Deer, *Odocoileus virginianus*, Killed in Motor Vehicle Collisions On Bulloch County Roadways

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Edward B. Mondor

White-tailed deer (*Odocoileus virginianus*) are native to the state of Georgia. As there are over 1.2 million individual animals in the state, they are implicated in a large number of motor vehicle collisions (ca. 1 million) each year. It is currently unknown, however, if deer are more likely to be killed: 1) at certain times of year, 2) of particular age classes, and 3) on roads with particular characteristics. We addressed these questions by collecting the remains of white-tailed deer killed in motor vehicle accidents in Bulloch County, GA. When a deer was located, the head was removed. In the lab, the lower jaw was excised so the deer could be aged by: 1) tooth eruption sequence and 2) cementum annuli aging of incisors. From the results, we hope to better understand the factors influencing white-tailed deer mortality rates.

P37 Testing the Potential Allelopathic Effects of the Non-Native Garlic Mustard (*Alliaria petiolata*) on Saprotrophic Fungi

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Jonathan Horton

Forested ecosystems around the world are becoming widely vulnerable to non-indigenous plant invasions. *Alliaria petiolata* (Bieb.) Cavara & Grande (garlic mustard, Brassicaceae), a naturalized exotic plant species, has successfully invaded woodland habitats across much of the eastern United States because of its highly competitive abilities and the production of allelopathic compounds. The species can limit the growth of native understory species thereby altering community composition and biodiversity by disrupting relationships with various mycorrhizal symbionts; however, the potential adverse effects of garlic mustard allelopathy on saprotrophic fungi has not yet been assessed. We experimentally tested the effects of garlic mustard on growth and fruiting of a widespread saprotrophic fungus, oyster mushroom (*Pleurotus ostreatus*). First year garlic mustard was planted in plastic bins with oyster mushrooms over a 16-week period and were monitored for fruiting body production. *Alliaria petiolata* invaded soils did not have a significant effect on the fruiting body mass of oyster mushrooms, but could have potentially altered the timing of fruiting body production. We also examined the potential allelopathic effects of *A. petiolata* on decomposition rates in heavily invaded and uninvaded areas in the Pisgah National Forest of Western North Carolina. Twenty pairs of litterbags were placed in the field in April 2015. A random subset of these was retrieved after six months in the field and decomposition rates were calculated from mass lost over time. Under field conditions, we found no significant difference in decomposition between garlic mustard invaded and uninvaded plots. However, there was a nearly significant ($p = 0.06$) decrease in decomposition with increasing garlic mustard stem density. Decomposition rates may have also been confounded by the abundance of an allelopathic tree species, black walnut (*Juglans nigra*) at the site.

P38 Keeping pace or losing ground: Quantifying barrier island response to sea level rise

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Barrier islands are at the forefront of global climate change, vulnerable to both sea level rise and the threat of increasingly frequent and stronger oceanic storms. These dynamic landforms provide valuable ecosystem services ranging from protection of the mainland from storms and wave erosion, creating and sheltering back bays and estuaries that support productive oyster and fishing industries, to providing critical habitat for many endangered organisms. A key feature of barrier islands is the capacity to "rollover" (i.e., overwash of sediment onto existing marsh platform) and migrate landward due to sea level rise. We used decadal remote-sensing analysis to assess state change from marsh to barrier island upland on the undeveloped Virginia barrier islands over 27 years (1984-2011). Over the time period, 20% of back barrier marsh area was lost. Sea level rise (marsh to ocean) caused greater loss of marsh area than conversion to upland. During the same time period, woody vegetation cover increased by 40% across all islands, potentially blocking significant amounts of sediment from washing onto the marsh and thus inhibiting rollover. Although state changes varied from island to island, several major trends were highlighted across the entire system; overall marsh and island area was being lost, an increasing portion of that marsh loss could be attributed to sea level rise rather than overwash, and woody vegetation was rapidly expanding. Measuring these changes are key to understanding and modeling the response of barrier islands to sea level rise and storm events. Expansion of woody vegetation and the rising proportion of marsh area lost to ocean are indicators that barrier islands may be unable to keep up with the exceptionally high rate of sea level rise in coastal Virginia.

P39 Prescribed fire effects on growing conditions and recruitment of upland oak and competing species

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Across most of the eastern United States, upland hardwood forests are beginning to shift from predominantly oak forests, to more competitive, shade tolerant species due to lack of fire in the ecosystem. Prescribed fire can help eliminate the seedlings of shade tolerant species that are out-competing oak seedlings, as well as increase under-story light and reduce the soil organic layer. The commonality of successful prescribed burns used to maintain upland oak forests are a rare case and most prescribed burns are not even conducted on upland oak forests. As part of a long-term seedling population growth and survival study at Bernheim Arboretum and Research Forest in Clermont, KY, single and multiple (2x) fires were applied over 3-yr and 5-yr periods on six sites paired with unburned plots. In the wake of a Chestnut Oak masting event, we chose to measure soil organic layer, canopy cover, and gather tree seedling densities for species less than 2yrs old for red oak (Quercus sect. lobatae), hickory (Carya), red maple (Acer rubrum), chestnut oak (Quercus montana), and white oak (Quercus alba). On burned sites, canopy cover and soil organic layer decreased, but red maple seedlings were still the most abundant species. Because of canopy cover being minimal and oaks require high light levels to survive, burns were ineffective at promoting oak regeneration. The analysis of the results suggests that even with fire, white oaks cannot compete with shade tolerant species. Future implications indicate that without sufficient over-story mortality from burning, a shift away from oak dominance will continue. Fires may not be able to positively influence oak densities and germination relative to red maple. This study helps determine to what extent fire should be used for in forest management and how fire should be reintroduced to upland oak forests.

P40 Exurban development and shrubland birds: opportunity or catastrophe?
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Michael Conroy, Jeffrey Hepinstall-Cymerman, Paige Ferguson

Exurban development covers at least 25% of the contiguous United States and alters avian communities. Previous work has demonstrated that exurban development impairs habitat for certain forest songbirds that occupied the landscape prior to development and creates habitat opportunities for species adapted to urbanization. In this study, we investigate the potential for exurban development to create habitat opportunities for shrubland birds. We hypothesized that (1) omnivorous temperate migrants would show higher occupancy probabilities than insectivorous Neotropical migrants, (2) occupancy probability would be most affected by the percent of the landscape that was developed, and (3) the disturbance caused by exurban development would benefit at least a subset of shrubland birds. To address these hypotheses, we conducted point counts in Macon County, North Carolina, across a spectrum of land uses and land covers. We used a hierarchical occupancy model to estimate occupancy, true positive detection, and false positive detection probabilities for twelve species of shrubland birds. For each species, we created twenty-four candidate models incorporating local- and landscape-scale covariates. We then performed model selection using Bayesian Information Criterion. Occupancy probability varied considerably among species, and omnivorous temperate migrants had higher occupancy probabilities than insectivorous Neotropical migrants. Contagion-a metric of landscape heterogeneity-was the most frequently appearing covariate in the selected models. We conclude that disturbed landscapes are by nature heterogeneous, and therefore landscape heterogeneity predicts suitability for shrubland birds. We also conclude that, while exurban development provides marginal benefit for adaptable shrubland species such as Song Sparrow and Eastern Towhee, species of conservation concern such as Prairie Warbler and Yellow-breasted Chat receive little or no benefit. These and other sensitive species require disturbance to create heterogeneous landscapes with adequate amounts of early successional vegetation, but the disturbance associated with exurban development is apparently not sufficient to create suitable habitat.

P41 The physico-chemical relationship between an open and closed canopy reach of a first-order stream, containing *Elimia paupercula*
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Terry Richardson

The physico-chemical parameters of water can promote or depress individual growth of organisms and potentially alter population and community structure. Freshwater mollusks, such as the snail *Elimia paupercula*, are of special concern due to highly permeable tissues and water quality requirements. We examined the water quality of a first-order, spring fed, stream inhabited by *E. paupercula* located in Lauderdale Co., AL. Dissolved oxygen, temperature, conductivity, pH, alkalinity, total hardness and calcium hardness were measured once a month at either an open or closed canopy reach at approximately the same time of day for each sampling event. The data show seasonal variation in the temperature and dissolved oxygen of the stream, as expected. However, low variation in the conductivity, pH, alkalinity, total hardness and calcium hardness was observed. The data from this study suggest a moderately buffered and productive stream in terms of water quality and biota.

P42 Eco-hydrologic impacts of invasive evergreen shrub species in a headwater catchment area

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Chinese privet (*Ligustrum sinense*) is an evergreen shrub that is non-native in western North Carolina. When privet is introduced into areas that do not usually have evergreen shrubs, like many eastern deciduous forests, it can impact the ecosystem, especially in winter. One possible impact results from winter evapotranspiration (ET) of the privet. For instance, in the Gribble Gap watershed in Cullowhee, NC, diel fluctuations in stream discharge associated with ET increased in the winter months. This wintertime ET signal is hypothesized to result from the dominance of privet in riparian areas of the Gribble Gap watershed. The purpose of this study was to use aerial imagery and field mapping using GPS to identify and delineate areas of privet in a headwater catchment in western North Carolina. This privet distribution map will then be utilized to compare winter ET measurements for privet (or a similar species) to estimate the daily water flux from ET using the spatial coverage determined using these mapping methods. This would be one way to demonstrate the feasibility that ET fluctuations measured in streamwater are at least in part a result of the presence of privet.

P43 Tree-ring analysis of longleaf pines (*Pinus palustris*) in Ocala National Forest, Florida

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Tree ring growth can be an excellent proxy for assessing climate patterns over the past few centuries. The purpose of this study was to reconstruct the climate of the Ocala National Forest (NF), Florida, using tree-ring data, and to examine the variations in growth due to climate (i.e., precipitation) over the past 100+ years. Raw data consisted of standardized tree-ring chronologies, as well as precipitation, temperature, Palmer drought severity index (PDSI), Palmer hydrological drought index (PHDI), and Southern Oscillation Index (SOI) data. By measuring the relative thickness of early and late stage growth in longleaf pine (*Pinus palustris*) core specimens, we aimed to determine annual growth relative to annual wetness within a 20-hectare area of Ocala NF. This information will also be used to extend the 20 year-long monitoring study by Greenburg and others, and bridge the said study to the paleoclimate record analyzed by Douglas and Tanner on local sinkhole wetlands, which spans 2,500 years, effectively creating a link between these two records, thus giving a full climate history for the site. This history will be used as a tool for U.S Forest Service personnel for the management of longleaf pine-wiregrass ecosystems and associated wetlands on the site.

P44 Where Does the Elusive American Ginseng Grow Best? Experimental Field Trials

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American ginseng (*Panax quinquefolium*) is a shade tolerant herbaceous perennial that has been a valuable, non-timber forest product for the last 300 years. Ginseng is becoming increasingly rare in the wild mostly due to over-harvesting. The increasing market demand for ginseng root and declining population numbers has caused a surge in ginseng cultivation. In this study, we examined slope aspect

and soil type to address inconsistencies in the literature regarding optimal locations for ginseng growth. We implemented a three by two factorial design (soil*slope aspect) at a field site in an Appalachian Cove forest system in West Virginia. Soil was transplanted from three forest sites: calvin series (fertile loam that was limed), macove series (fertile loam), and dekalb series (cobbly, sandy loam). Seeds were planted in raised beds at six sites in the fall of 2014. All beds were placed in gaps with approximately 30% light. We predicted that leaf area, height, and survival of three-year-old plants would be significantly greater in limed loam soil on north-facing slopes. Soil had a significant effect on height and leaf area. ($p<0.0001$) Height and leaf area were greatest in the limed loam soil. Aspect also had a significant effect on height and leaf area with values being greatest on northern slopes. ($p<0.0001$) Survival ranged from 0% to 27.21% at each of the six sites. On average, plants in the calvin series were 19.36% taller than plants in the macove series, and 17.29% taller than plants in the in dekalb series. An understanding of how environmental variables affect ginseng's growth and performance will help with the development of successful reintroduction plans.

P45 Prescribed fire and canopy gap disturbance impacts on upland oak regeneration

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Heather Alexander

In the eastern United States, fire suppression has contributed to extensive oak regeneration problems and a compositional shift towards more shade tolerant species with the potential to modify ecosystem dynamics. Prescribed fire may maintain upland oak ecosystems by removing competing species and increasing understory light however, successful fire regimes have yet to be identified. In western Kentucky, single and multiple (2x, 3x) fires were implemented over 3-yr and 5-yr periods, on six sites with control plots. Each year during growing season, canopy cover, annual growth, height, basal diameter and survival were quantified for white oak (*Quercus alba*), red oak (*Q. coccinea*, *Q. rubra*, *Q. velutina*), chestnut oak (*Q. montana*), hickory (*Carya glabra*, *C. tomentosa*), red maple (*Acer rubrum*) and American beech (*Fagus grandifolia*) saplings to determine prescribed fire effectiveness at promoting oak regeneration. Additionally, canopy gap disturbances are being studied to understand trajectories of upland oak forests in the event that prescribed fire is not suitable for all management objectives. Gap size and age, are being analyzed to identify influences on composition and regeneration dynamics of oaks and competing species. Preliminary results suggest that single fires are ineffective at creating beneficial conditions for oak regeneration while multiple prescribed fires can promote oak growth relative to competing species after fire free periods. This may be because single fires had no impact on canopy cover, a proxy for understory light, whereas multiple fires caused ~10% reduction in canopy cover, although this effect tended to subside several years post fire. Canopy gap data suggest that gap size and age influence species composition and stand dynamics, with larger gaps having greater oak dominance than smaller gaps. This study could direct how prescribed fire can preserve upland oak ecosystems and provides information on potential dynamics of upland forests in canopy gaps with continued fire suppression.

P47 Species-specific leaf litter traits influencing forest bed flammability

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Mesophication is a proposed hypothesis to explain the phenomenon in forests in the eastern United States whereby typically oak-dominated forests are becoming increasingly suitable for mesophytic, fire-intolerant, shade-tolerant species, like red maple (Acer rubrum). This has become an important focal point of discussion in ecological circles as mesophytic tree species spread in greater numbers and threaten the species diversity of North American upland oak forests. However, there is an abundance of rhetoric about this concept and a lack of empirical data from an appropriate range of locations throughout the southeast. To address this issue, I will quantify species-specific leaf litter traits so we are able to better understand how a change in species composition will affect the flammability of forest floor beds. Leaf litter samples were taken of red maple, sugar maple (A. saccharum), red hickory (Carya ovalis), white oak (Quercus alba), and chestnut oak (Q. montana) throughout Bernheim National Forest in Clermont, KY. Leaf litter will be measured and tested to quantify traits, such as leaf toughness, curling, size, thickness, ability to hold moisture, and amount of interception. We hypothesize that this will support the concept of mesophication by showing that an increase of mesophyte leaf litter reduces forest floor flammability. For example, if mesophyte leaf litter is thinner, weaker and curls less than oak species then it may lay more densely on the forest floor, which would reduce aeration to the litter allowing it to hold moisture longer over time. This would make it less susceptible to fire. Identifying species-specific differences in leaf litter such as these is essential to understanding potential mechanisms by which mesophytes could alter forest flammability and is vital to understanding how these forests will change in the future.

P48 Understanding how land use patterns affect spatial distribution of ticks and tick-borne diseases.

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Understanding anthropogenic effects on spatial disease patterns remains an essential task in combating emerging and reemerging disease. We used a multi-disciplinary approach to identify land use and land cover patterns that contribute to pathogen distribution and prevalence. We collected ticks at a national scale by soliciting submissions via social media. Ticks received (n=5782) were separated based on origin, species, life stage, degree of engorgement, and sex. We first studied the distribution of ticks and the presence of Rickettsia sp., the pathogens of Rocky Mountain Spotted Fever (RMSF), in the southeastern United States. DNA was extracted from ticks, 16S rDNA of all bacteria was PCR-amplified, and Rickettsia-specific primers were used for nested-PCR. The amplicons were sequenced and the sequences were analyzed. We used GLMs and AIC model selection to predict the occupancy patterns of ticks based on local land cover patterns. Occupancy of Brown Dog and Gulf Coast tick in the southeast was best described by the loss of forest cover; with the replacement of forest by the built environment increasing occupancy. We took a similar approach to study the distribution and prevalence of Borrelia burgdorferi, the pathogen of the Lyme disease, in ticks in the upper Midwest and New England areas. We extracted the DNA from ticks from the said areas and looked for the signature DNA that is uniquely B. burgdorferi. A total of 574 ticks were processed with 28 positive results. In the Midwest and New England areas, Brown Dog ticks were less abundant as deciduous forest cover increased, and Lone Star ticks more abundant with greater pastureland. Future work aims to establish models to determine how to best prevent tick borne disease as our built environment expands.

P49 Effects of estradiol and progesterone on nerve activity of *Procambarus clarkii*

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Fertilizers, pesticides, and medications that contain steroidal hormones or hormone mimics have detrimental effects on reproduction and development of aquatic species. While studies have focused on these physiological effects, little is known about effects on nerve activity following acute exposure of these hormones. The goal of this study was to investigate the effects that the steroid hormones 17-beta estradiol and progesterone have on the nerve response of the crayfish (*Procambarus clarkii*) for both stimulated and unstimulated nerves. Following dissection, nerve three of a tail segment was exposed to 20µM 17-beta estradiol, progresterone, or vehicle (n=6/treatment) for five minutes. To quantify the nerve response, we recorded the number of action potentials over a time interval of 20 seconds using a suction electrode and BIOPAC MP30 data acquisition unit. Following tail stimulation, there was a significant decrease in the number of recorded action potentials in the hormone-treated groups compared to the control group ($p<0.001$). There was no significant difference across treatment groups in unstimulated crayfish ($p=0.67$). Given these results coupled with published studies, it is important to understand the future implications as these substances are continually entering into the environment. Future studies should focus on looking at differing concentrations of 17-beta estradiol and progesterone, acute vs. chronic exposure, and conjugated forms of these hormones.

P50 Natural Selection on Growth and Locomotor Development in Eastern Cottontail Rabbits

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The morphology and performance of animals can have an impact on their fitness. Most animals have unique abilities and traits that can help them find shelter, food, and protection from predators. Natural selection has shown to play a role with animals that have more advantages to their environment. Immature animals must accomplish the same basic survival functions as adults despite the smaller body size and other growth-related limits on performance. In order to understand how morphology, performance and survivorship are associated with natural selection, rabbits ("Sylvilagus floridanus") were captured, anesthetized, weighed and fitted with a VHF radio collar. Rabbit sprint speed and acceleration were also measured. The data collected was analyzed and correlated with cause of death to better understand how natural selection is shaping rabbit populations.

P51 Germination of *Amaranthus caudatus* as influenced by increasing salinity

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Selecting salt-tolerant ornamentals is an important consideration as soils world-wide become increasingly salinized. Elucidating the relationship between increasing saline soils and germination rate is unknown across many widely used ornamental species. We assessed the effect of salinity on seed germination of *Amaranthus caudatus* (Amaranthaceae), a food crop and ornamental garden plant, by determining germination seed rates and percentages when exposed to a range of

increased salinity. Four replicate Petri dishes each containing 25 seeds were exposed to a control (dH2O) and three treatments of 1%, 2%, or 3% NaCl. Seeds were exposed to constant 23ï‚°C with alternating 12-h dark and 12-h light in a Percival incubator and were monitored daily for ten days. Germination in the control was 86±3% (mean±SE). No seeds germinated in the 1% NaCl treatment and a single seed germinated in both the 2% and 3% NaCl treatments. A Kruskal-Wallis one-way ANOVA on ranks showed a significant difference between at least two groups (H = 8.73, df = 3, P = 0.03). Results of the Kruskal-Wallis multiple comparison z-value test showed that the control was significantly different than all three treatment groups (z-value > 1.96). Rate of germination using a Timson index was 73.7, 0.0, 1.0, and 0.8 in control, 1%, 2%, and 3% NaCl, respectively, with most seeds germinating within three days. A Kruskal-Wallis ANOVA test on total germination after germination recovery in distilled water indicated significant differences between treatment groups. Total germination of seeds of *A. caudatus* exposed to 2% and 3% NaCl was significantly lower than the control, indicating a specific ion effect after exposure to NaCl. Further investigations are necessary to determine if *A. caudatus* is more tolerant to NaCl at later developmental stages.

P53 DNA Barcoding of *Quercus margaretta* from TN to Validate Morphological Identification and to Determine Efficacy of Different Barcoding Regions to Determine *Quercus* Species Resolution

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Michael Schiebout

In 2004, a population of sand post oak (Quercus margaretta Ashe) was morphologically identified on the Wolf River Wildlife Management Area in Fayette County, marking the first discovery of Q. margaretta in the state of Tennessee and an extension of the species' range. We isolated and amplified plastid and nuclear DNA barcodes rbcL, matK, psbA-trnH, and ITS2 from this population by PCR. Our research objectives are first to determine if these coding regions in the TN plants are similar to the same barcode regions we have isolated from a FL population to evaluate if the genetic data supports the morphological identification of the TN population. The second objective is to determine if the selected barcodes offer appropriate variation alone or concatenated to be used to determine species resolution in selected Quercus species. This will be done through phylogenetic analysis using our sequence data and sequence data obtained from online databases.

P54 EPIC Markers for Understanding Evolutionary Diversification in Platanthera section Limnorchis (Orchidaceae)

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Nicholas Bailey, Lisa Wallace

Platanthera (Orchidaceae) is one of the largest genera of temperate orchids, with more than 200 species occurring in north temperate areas. Previous phylogenetic analyses in this genus have identified major radiations of species and tested sectional boundaries with respect to closely related genera, but we still lack a clear understanding of relationships among species within these major clades. Platanthera section Limnorchis has been identified as monophyletic in these previous analyses, and this group has long been recognized to be morphologically distinct from other Platanthera in North America. However, the recognition of several new species recently and morphological similarity of U.S. species with congenerics in Mexico and Asia have hindered a thorough understanding of species diversity and phylogenetic relationships in Limnorchis. In this project, we developed

six novel exon-primed-intron-crossing (EPIC) markers (>4100 base pairs) to estimate the phylogeny of section Limnorchis. Preliminary phylogenetic results of sequence variation in these markers are presented to test two hypotheses: 1) Section Limnorchis is monophyletic relative to other Platanthera species, 2) Species diagnosed by morphological characters are genetically divergent and represent distinct evolutionary lineages. The EPIC loci show variation among species of section Limnorchis and may aid in increasing resolution in areas of the ITS phylogeny that have not been resolvable. Two phylogenies exhibit some incongruence and this may be influenced by the fewer number of samples used in the EPIC data sets and presence of indel heterozygosity. EPIC markers are expected to amplify broadly within Platanthera and should be useful in resolving phylogenetic relationships in both closely and distantly related species as well as for intraspecific projects involving phylogeography, gene flow, and hybridization. These results will assist in revising the taxonomy of section Limnorchis, studying the evolution of flower morphology, and testing biogeographic hypotheses of diversification across North America.

P55 Phylogenetic Relationships of the Genera of Achariaceae Based on Analyses of Morphological and DNA Data

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Mac Alford

Achariaceae are a mostly tropical family of flowering plants consisting of about 29 genera and 150 species of trees and shrubs. Although they are closely related to passionflowers (Passifloraceae) and willows and cottonwoods (Salicaceae), relationships of the genera have never been studied, and few studies of the family in general have been conducted, except for a few on species that produce chaulmoogra oil, a commonly used treatment for leprosy in the past. For my study, I investigated he relationships of the genera within the family using morphological and molecular data. For morphology, I created a data matrix of 35 features, and for DNA, I collected data from two chloroplast regions (*ndhF* and *trnH-psbA*) and one nuclear region (GBSSI). Phylogenetic analyses of these data indicate that the tribes within the family are not monophyletic and that the family consists of two major clades.

P56 Phylogenetic Relationships and Character Evolution in the Closest Relatives of Willows (Salix) and Cottonwoods (Populus), Salicaceae

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Mac Alford

Salicaceae are an economically and ecologically important family of flowering plants. The family includes willows and cottonwoods and was recently enlarged to include a large number of tropical species. Relationships of these tropical relatives relative to willows and cottonwoods has been explored at a basic level, but to date no molecular phylogenies have been constructed with significant sampling of nuclear DNA. For this project, I sampled several regions of nuclear DNA across the family to infer relationships among the genera of Salicaceae, and several more nuclear regions and a small chloroplast region with a focus on the seven genera hypothesized to be the closest relatives of the willows and cottonwoods.

P57 Combing out evolutionary histories in the *Phlox glabberima*/*P. carolina* species complex

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Gerald Bresowar

Phlox glaberrima L. and *P. carolin*a L. are extremely similar with various overlapping characters delineating species and subspecies boundaries. As a result, it is often difficult for researchers to confidently determine taxonomic identity, leading to a need to clarify the relationships at the species and subspecies/varietal level. Issues such as recent diversification with ongoing hybridization, local adaptation, chromosomal variation, and plasticity in delineating characters may be contributing to confusion in the group. Here we present on research on plastid and nuclear (ITS) diversity across 51 sampled individuals of *P. glaberrima* and *P. carolina* from throughout the species' southeastern distribution. This preliminary research will be incorporated into a larger investigation of evolutionary history in these and other closely-related *Phlox*.

P58 On the Evolution and Phylogeography of the Southeastern Species of the Genus *Dalea* L. (Fabaceae) Using a Phylogenetic Approach

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The genus *Dalea* (Fabaceae) consists of approximately 160 species with a few species being geographically widespread, and most of the genus being endemic to restricted areas with calcareous substrates. A previous study (McMahon and Hufford, 2004) looked at the phylogeny of the tribe which *Dalea* belongs to, Amorpheae, and one other phylogenetic study (Diggs, 2013) has been conducted on the genus itself. This study focuses on the phylogeny and phylogeography of *Dalea* species from the Gulf Coastal Plain, including *D. carnea, D. carthagenesis var. floridana, D. feayi, D. pinnata var. pinnata,D. pinnata var. trifoliata, D. adenopoda, D. mountjoyae*, and *D. albida*. Phylogeny for *Dalea* will determined by DNA sequences taken from the plastid *trnK/matK* intron, and the nuclear ribosomal ITS1, 5.8S, and ITS2, and compared to sequences obtained from previous phylogenetic studies of *Dalea* (Diggs, 2013). Currently, no results have been ascertained, but samples have been collected and the DNA extracted.

P59 A preliminary examination of the plant genus *Corymbium*

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The plant genus *Corymbium* (Asteraceae) is endemic to the fynbos biome of the species rich Cape Floristic Region of South Africa. Its unique morphology belies its evolutionary origins: It has strap-shaped parallel veined leaves that arise from a rhizome, and corymbs of capitula that bear a single complete flower each. The genus was recently placed into its own tribe of its own subfamily, Corymbioideae, and the current study will attempt to substantiate this position through genetic analysis employing each of the species. Prior morphological studies have produced 14 taxa, including three varieties of subspecies. Many of the taxa are difficult to distinguish from one another, so the current study also will incorporate phylogenetic and micromorphological analysis into the body of works to elucidate species boundaries.

P60 A Distributional and Taxonomic Study of *Lathyrus* (Fabaceae) in Alabama.

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Michael Woods

Lathyrus Linnaeus, commonly known as sweet peas is a member of the legume family Fabaceae (Leguminosae). The genus consists of approximately 140 species of herbs which are distributed throughout the temperate portions of the world. Of these, six species have been reported from Alabama. Based on the results of this study, the most common species of *Lathyrus* in the state is *L*. *hirsutus*, represented in 47 counties. *L*. *latifolius* is represented in 28 counties and *L*. *venosus* is represented in 12 counties. The least common species are *L*. *pusillus* (three counties), *L*. *odoratus* (two counties) and *L*. *aphaca* (one county). Dichotomous keys and descriptions are modifications from earlier authors; however, all measurements are based on morphological features of the vegetative and reproductive structures of the plants studied during the project. Data for the distribution maps were gathered from personal collections and plant specimens deposited in the herbaria of Troy University (TROY) and the specimens on loan from the herbaria at Anniston Museum of Natural History (AMAL), Botanical Research Institute of Texas (BRIT), Jacksonville State University (JSU), John D. Freeman Herbarium at Auburn University (AUA), Jacksonville State University (JSU), Samford University (SAMF), University of Alabama (UNA), University of North Alabama (UNAF), University of South Alabama (USAM), and University of West Alabama (UWAL).

P61 The genus *Medicago* (Fabaceae) in Alabama.

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Michael Woods

Medicago Linnaeus, commonly known as medick, is a member of the legume family Fabaceae (Leguminosae), tribe Trifoliae and subtribe Trigonellinae. The genus consists of 87 species of shrubs and herbs which have a geographical distribution from Mediterranean to central Asia. Thirty-nine of these taxa have been introduced to the United States. Of these, 7 species have been reported from the southeastern United States and Alabama. Based on the results of this study, the most common species of *Medicago* in the state is *M*. *lupulina* represented in 42 counties. *Medicago* *polymorpha* is represented in 20 counties and *M*. *arabica* is represented in 17 counties. The least common species are *M*. *sativa*, represented in nine counties, *M*. *orbicularis* in seven counties, and *M*. *minima* and *M*. *littoralis* both found in two counties. Dichotomous keys and descriptions are modifications from earlier authors; however, all measurements are based on morphological features of the vegetative and reproductive structures of the plants studied during the project. Data for the distribution maps were gathered from personal collections and plant specimens deposited in the herbaria of Troy University (TROY) and the specimens on loan from the herbaria at Anniston Museum of Natural History (AMAL), Botanical Research Institute of Texas (BRITT), Jacksonville State University (JSU), John D. Freeman Herbarium at Auburn University (AUA), Jacksonville State University (JSU), Samford University (SAMF), University of Alabama (UNA), University of North Alabama (UNAF), University of South Alabama (USAM), and University of West Alabama (UWA).

P62 DNA barcoding of *Quercus falcata*, *Quercus palustris*, *Quercus rubra* and their hybrids using rbcL and matK genes

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It is estimated that there are around 400,000 plant species on earth. These plant species can be identified using DNA fragments through a process known as DNA barcoding. However, barcoding some interspecies hybrids has repeatedly proven problematic. *Quercus* species in particular provide mixed results. The goal of this study was to determine if the commonly used primer sets rbcL and matK could be used together to distinguish between several local *Quercus* species (*Quercus falcata*, *Quercus palustris*, and *Quercus rubra*). DNA extracted from expanded whole leaves was amplified using rbcL and matK primer sets. Purified PCR fragments were sequenced then aligned and compared using Clustal Omega to determine percent identity. Twenty-five different oak samples were collected. Sixteen samples yielded a single successful PCR product useful for sequencing. Sequence analysis of rbcL fragments is ongoing and preliminary results have been insufficient to answer our question. Continued research will incorporate analysis of matK fragments. It may also include an expanded data set and additional primer sets such as ycf1 to improve our ability to distinguish between these closely related species.

P63 Larval zebrafish as an in vivo model to study gut motility disorders

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Our research is focused on understanding how human gut motility disorders arise postnatally from developmental defects of gut patterning. Several zebrafish lines already exist for modeling specific genetic mutations that disrupt gut motility. Our goal is to extend these genetic studies to include functional assays that go beyond embryonic stages. To achieve this, we are developing the larval zebrafish as a model for studying gut motility. Larval zebrafish offer advantages as a model, including transparent body walls and a straight gut tube, that allow relatively easy imaging of the gut contents in live fish. We have found that a meal of brine shrimp is highly visible through the body wall of young larvae. We have also found that larvae will eat brine shrimp as early as 5 days post fertilization. Gut imaging and gut transit assays can therefore be performed within the first week of larval life, making zebrafish a convenient tool. Here, we present preliminary results from performing a gut transit assay on young wild-type larvae. As the zebrafish matures, gut morphology becomes more complex, and we hypothesize that structural changes may be associated with concomitant changes in gut function, consistent with numerous other functional changes that zebrafish undergo during maturation. However, visualizing gut function or gut contents in older fish is challenging because of increased pigmentation of the body wall. To try to overcome this difficulty, we plan to feed fluorescent brine shrimp to the fish and to test whether the shrimp are visible through the body wall of older larvae. We present preliminary work generating fluorescent shrimp using transgenesis. The shrimp express either Green Fluorescent Protein or tdTomato protein.

P64 Larval zebrafish growth can be supported using brine shrimp as a supplement from the first meal

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Regimens for feeding larval zebrafish typically recommend using live rotifers or paramecia as a starter daily supplement, then transitioning to live brine shrimp (Artemia) when larvae are 2-3 weeks old. However, without a full-time technician, raising rotifers or paramecia can be daunting. Raising brine shrimp is much simpler, but most published regimens assume that Artemia are too large for young larval zebrafish to eat. The small larval gape (mouth opening) is thought to prevent them from capturing Artemia. We tested this assumption and found that zebrafish can eat brine shrimp at their first feeding, as early as 5 days post fertilization. We hypothesize that larvae may be using suction feeding to capture large prey, rather than engulfing prey with their jaws. An alternative or additional hypothesis is that larval zebrafish can more easily capture the smaller Artemia that we are using. The shrimp are smaller because they are harvested 18-24 hrs of culturing them. Thus, they are much smaller than the 48 hour old shrimp that are called for in most zebrafish rearing regimens. Also, we are using the San Francisco Bay strain of Artemia franciscana, which are generally thought to be significantly smaller than the Great Salt Lake strain of the same species. However, there appears to be no peer-reviewed literature that supports a size difference for the two strains. We have therefore begun to test this directly. In preliminary work, we have directly measured shrimp length by anesthetizing them, imaging, and determining maximum body length. This work suggests there is no difference in length between the two strains at hatching. In ongoing studies, we are comparing overall size by measuring volume. We are also performing feeding tests to determine whether one shrimp strain supports more robust growth larval growth than the other.

P65 Larval zebrafish rearing methods for small laboratories

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The larval stage is a period of rapid growth that requires a nutrient-rich diet. To support larval growth, lab personnel must consistently deliver food and care on a daily basis. Since larval fish are most vulnerable, larval rearing requires intensive care and can be quite time-consuming. To address these challenges, we developed a streamlined regimen that is easy to follow, even for new personnel. First, we use a low-cost tabletop nursery that is essentially a water bath. The nursery houses larvae from 5 days post fertilization (dpf) to 11 dpf. The larvae are held in small “baby” tanks, in 300 mL E3 embryo medium, within the nursery. Second, we pre-sort embryos into dishes of 50 prior to hatching. This allows us to maintain a consistent density of larvae for each baby tank. Third, we use a feeding method that we adapted from methods used by the Zebrafish International Resource Center (ZIRC). Briefly, a liquid suspension of powdered food is delivered to each tank using a serological pipet and an automatic pipetter. Using the food as a liquid allows delivery of a consistent volume and concentration per tank. Fourth, a streamlined tank cleaning method prevents larvae from being accidentally removed during cleaning. This step takes advantage of commercial tanks that have screens held in slots. The slots allow creation of a small fish-free chamber in the tank. Keeping the tank water clean is accomplished by adding excess fresh E3 medium, then using a siphon in the small chamber to bring the tank volume back to the starting volume. With these methods, we achieve between 75-100% survival rate. Additionally, the majority of larvae enter metamorphosis by 21 dpf. The success of this regimen is likely due to its focus on consistent daily care and the relatively fool-proof nature of the procedures.

P66 Developing a high-throughput social interaction behavior assay with Zebrafish Larvae

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Zebrafish are known to exhibit certain social behaviors, such as preferring the ability to view and observe other zebrafish from their tank or the well that they are contained in. Zebrafish would be expected to spend more time closer to where the other fish were contained rather than farther away. In this experiment, a well will be divided into two subunits by a clear divider. One side of the well will contain multiple zebrafish larvae, while the other side will only contain one fish. It is expected that the single larvae will spend time close to the divider in order to observe the group of larvae on the other side of the divider. Being able to quantify behavior in zebrafish is the key to further exploration and experimentation of learning and memory. Using this assay, behavioral abnormalities of autistic fish will be observed. Preliminary data conducted in the lab has shown that autistic zebrafish show reduced movement and exploration. Using this data, social behaviors of autistic fish will be further explored; it is expected that autistic zebrafish will not spend as much time next to the clear barrier as their counterparts. This behavioral assay can also be used to screen potential drugs that cause changes in behavior in zebrafish and autistic fish. Preliminary data shows that chemicals can be used to change behavior in zebrafish, thus, a drug that enhances behavior will be expected to have an effect on autistic fish in terms of their time spent near the barrier. Zebrafish larvae is a unique vertebrate model to study behavioral changes because it not only allows us to understand the underlying cellular or physiological aspects in the brain, but can also allow for quantitative assessment of induced behavioral changes and identify potential drug candidates that can alter behavioral phenotypes in a high throughput manner.

P67 The Effects of Deazaflavin induced TDP2 inhibition with etoposide treatment in MDA-MB-231 cell culture

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TDP2, or tyrosyl DNA phosphodiesterase 2, is a molecule that is active during transcription that hydrolyzes the 5'tyrosyl DNA adducts that are created from topoisomerase 2 double stranded cleavage. This prevents further DNA replication due to increased damage. Etoposide is a cell-cycle specific chemotherapy drug that prevents Top2 from releasing a strand of DNA and therefore increasing DNA damage and induces apoptosis. Previous studies have shown that TDP2 inhibitor administration with etoposide can be more effective when treating cancer. However, etoposide has been shown to have clinical toxicity at high dosage levels. In these experiments we observe the effects of using less etoposide in combination with TDP2 inhibition. In the near future we plan to look at the effects of these treatments in a zebrafish xenograph model by microinject MDA-MB-231/RFP cells at 24 hpf into zebrafish. We will treat the xenograph model at 30 hpf with the same etoposide/deazaflavin concentration from the MDA-MB-231/RFP treatment. This could prove to be a powerful model with which to test future cancer treatments.

P68 The effect of Top2β inhibition with Hu331 on expression of dcc in *Danio rerio*

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Previous research from our lab has shown that Zebrafish embryos treated with the Top2β inhibitor Hu331 form mauthner neurons that do not properly extend their axons across the midline. The molecular cause of this phenotype is not yet understood. Past studies and the literature have shown that chemo-attractants and repellents play a major role in the development of these neurons. We chose to examine the expression of Dcc, a Netrin-1 receptor, using qRT-PCR in embryos exposed to Hu331. Dcc plays a vital role in axon guidance and loss of Dcc expression causes a phenotype similar to that observed in Hu331 treated embryos. However, our data does not support misregulation of "dcc" expression as the cause of our Hu331 phenotype, the qRT-PCR results suggest that "dcc" expression is unchanged in Hu331 embryos. Continued replicates and examination of additional factors involved in neural development will further our understanding of the role of Top2β in axon guidance.

P70 Zebrafish Tumor Xenograft Model in Identifying Anti-Cancer Activity of Quinone-Based Complex

Paul Lascuna , Vinoth Sittaramane

Cancer is the uncontrollable division of abnormal cells, leading to malignant growth within the body. The American Cancer Society estimates that nearly 600,000 deaths occur in the United States every year as a result of cancer; therefore making cancer the second leading cause of death in the United States. Current treatment strategies rely heavily on early diagnosis and often involve intense chemotherapy. However, these chemotherapeutic strategies often come with serious side effects due too non-specificity. Novel drug targets and chemical compounds with enhanced specificity are in high demand. Due to their prodigious phenotypic characteristics, in vivo zebrafish have emerged as a preferred model organism for the screening of novel anticancer drugs. Quinone-based complexes are novel compounds that have been previously shown to enhance free radicals specifically in cancer cells, leading to cell death. Preliminary data has shown that quinone-based complexes attached to ligated gold (I) displayed anticancer activity on cultured A549 lung cancer cell lines. However, the in vivo anti-cancer activity of this complex has not been studied yet. In this study, we used zebrafish-human tumor xenograft models to evaluate the specificity of this quinone-based complex. A549 lung cancer cells were transplanted into the yolk of zebrafish larvae and allowed to grow for at least 24 hours. The tumor xenografts were then exposed to various concentrations of the quinone-based complex for twenty four hours and the live larvae were stained for cell death utilizing acridine orange. If the complex is specific to A549 lung cancer cells, we can expect to see cell death localized to cancerous regions. Our studies will elucidate the specificity of quinone-based complexes while also providing a framework for maximum tolerable dosing.

P71 Preliminary comparison of L-cysteine, N-acetyl-L-cysteine, and apple peel protective effects on acrylamide toxicity in embryos of *Xenopus laevis*

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Following the announcement of findings that acrylamide, a toxic and potentially cancer-causing chemical, is formed in many types of food prepared/cooked at high temperatures (+120°C), acrylamide toxicity has become a public health and food safety concern. Dietary acrylamide is largely derived from heat-induced reactions between certain sugars and an amino acid (asparagine) that occur naturally in the food. Acrylamide is found in products such as potato chips, French fries, bread, coffee, and cereals. After consumption, acrylamide is absorbed into the circulation and distributed to various organs where it can react with DNA, neurons,

hemoglobin, and essential enzymes. This present study was designed to investigate protective effects of N-acetyl-L-cysteine (NAC) and apple peel in comparison to L-cysteine (CySH) on acrylamide-induced developmental toxicity in the frog embryo teratogenesis assay- Xenopus (FETAX). FETAX is a rapid test for identifying potential developmental toxicity of chemicals/mixtures. To test the protective potential, we selected a concentration of acrylamide that would cause significant mortality and malformations. Early stage (< small cell blastula stage) *X. laevis* embryos were exposed to acrylamide, CySH, NAC, apple peel, or a mixture of protectant and toxicant for 96 hours (solutions statically renewed every 24 hours). At 96 hours, mortality, malformation, and length were recorded. The 96-hour LC50 (concentration to kill 50% of a population), 96-hour EC50 (concentration to cause malformations in 50% of a population), and the Teratogenic Index (TI=LC50/EC50) were calculated using Bonferroni's multiple comparison test via Systat 13. The data show that CySH and NAC protected the embryos against acrylamide induced malformation and mortality to different degrees. Apple peels show potential as protective agents but were not significant.

P72 The Potential protective effects of L-cysteine on the developmental effects of acetaminophen,caffeine,and sea salt using Frog Embryo teratogenesis Assay-FETAX

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Three educational workshops conducted to investigate chemicals toxicity and their teratogenic effects in Frog Embryo Teratogenesis Assay FETAX. FETAX is a rapid, 96-hour, test to assess the chemical developmental toxicity. In this study, three chemicals, which are acetaminophen, caffeine, and sea-salt, were tested in FETAX. Acetaminophen used as a pain reliever and antipyretic agent. Caffeine is a stimulant substance. L-cysteine is an amino acid that is synthesized in the body. Therefore, L-cysteine is categorized as semi-essential amino acid. Several studies have shown the protective role of L-cysteine as a source of glutathione that will detoxify the toxic substances. The purpose of this study is to determine if L-cysteine can reduce the developmental effects of acetaminophen, caffeine, and sea salt. The hypothesis for this study is to determine the protective roles of L-cysteine. A total number of 560 xenopus were used for each experiment in this study .The study was conducted three times. For each treatment group 80 embryos were exposed in four groups of 20 each. The solutions were prepared and changed at the beginning of each day. Also, the dead embryos were removed from the dishes to avoid any contamination. In the last day of the experiment, malformation types and severity were studied and documented. The results suggested that L-cysteine did not prevent acetaminophen toxicity significantly. The effects of L-cysteine on caffeine have shown a moderate reduction of the developmental toxicity effect. L-cysteine seemed to whom the greatest beneficial effect with the sea salt showing the greatest potential beneficial effect. These results are preliminary and more work needs to be performed to ascertain the degree to which L-cysteine reduces the developmental toxicity of these chemicals.

P73 The Potential Neuroprotective Effect of *Hexastylis Arifolia* Root Extract

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Hexastylis arifolia (H. arifolia), commonly known as wild ginger, has been studied for its anticancer and neuroprotective effects. To determine the effects of *H. arifolia* extract on cell viability, we conducted MTT assays using increasing

concentrations of *H. arifolia* extract. Our results indicate that *H. arifolia* does not have a toxic effect on COS7 cell viability. In addition, we found that *H. arifolia* does not affect superoxide dismutase (SOD) levels in treated C2C12 cells. Together, these results indicate a non-toxic effect of *H arifolia* extract on mammalian cells and support preliminary results indicating a potential neuroprotective effect of *H. arifolia* extract on PC12 cell neurite number and outgrowth.

P74 Establishing Conditions for the Pigmentation of Dopamine Neurons

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The loss of pigmentation from the human brain has been the hallmark of Parkinson's disease for over 300 years, yet we still know relatively little about the purpose of this pigmentation in the brain. Pigmentation is most pronounced in dopamine neurons of the substantia nigra, leading to a blackened appearance in these regions and resulting from an accumulation of the pigment neuromelanin. Neuromelanin levels decrease only in the diseased state following the immune-mediated death of pigmented cells. Thus, loss of neuromelanin and subsequent depigmentation of these brain regions is characteristic in Parkinson's disease. There is evidence to suggest that dopamine neurons with high amounts of neuromelanin and pigmentation are more susceptible to degeneration. Establishing conditions for the pigmentation of dopamine neurons has not yet been achieved in cell culture. Thus, a major goal of this project is to replicate in cell culture the simultaneous accumulation of neuromelanin and reduction of tyrosine hydroxylase (TH), a marker for active dopamine neurons. Rat substantia nigra neurons were treated with L-DOPA to induce pigmentation. At the protein level, the correlation of dopamine transporter and tyrosine hydroxylase immunoreactivity identified dopamine neurons with and without TH. To determine whether protein changes resulted from transcriptional changes, TH mRNA levels were also measured. Our preliminary evidence suggests that TH may be reduced only at the protein level based on the immunocytochemistry results whereas RT-PCR revealed no changes in TH mRNA level.

P75 Finding a Role for Atg27 in the targeting of Pmc1 to the vacuolar membrane

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Autophagy is a conserved process in eukaryotic cells including human and baker's yeast cells. Autophagy targets cytoplasmic materials for delivery to the degradative organelle of the cell, the lysosome in human cells and the vacuole in yeast. Cells use autophagy to survive stresses like starvation, using it as a self-eating process to recycle nutrients and rid themselves of damaged cellular components. Atg27 is a transmembrane protein in baker's yeast that is known to be involved in autophagy where it serves as a protein adaptor for the transport and delivery of autophagy-specific protein cargos to their final destination in the cell. Recent data collected by other research groups suggests that Atg27 might also be a protein adaptor for protein cargos that are not related to autophagy. One of the potential Atg27-dependent protein cargos is Pmc1, a protein that is involved in calcium homeostasis. Pmc1 transports calcium ions across the vacuolar membrane, helping yeast cells to maintain a low cytoplasmic calcium concentration at rest. We want to know if Atg27 helps guide Pmc1 to the vacuole. We plan to assess this in two different ways. First, we plan to determine if cells deleted for the PMC1 gene and ATG27 gene, respectively, have similar sensitivities to high levels of extracellular calcium. If Atg27 is helping Pmc1 get to the vacuolar membrane, cells deleted for

the ATG27 gene should be sensitive to calcium ions, just as cells deleted for the PMC1 gene (no Pmc1 on the vacuolar membrane). Second, we will generate a strain of yeast expressing Pmc1 tagged with green fluorescent protein and examine whether the localization of the protein changes when Atg27 is not present.

P76 Optimizing Genomic DNA Extraction for a PCR-Based Screen of Myosin Genes in *Sabal yapa*

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Motor proteins are the basis of movement in biological systems. There are 3 major families of motor proteins: Myosins, Kinesins and Dyneins. This research project is focused on identifying new members of the Myosin superfamily. There are three classes of myosins that are known to exist in plants: classes VIII, XI, and XIII. Classes VIII and XI have been found in higher plants including flowering plants, and class XIII myosins are known to exist solely in algae, but no myosin gene has been reported in Sabal palm species. The objective of this study is to identify and characterize myosin genes in the palm Sabal yapa using a Polymerase Chain Reaction (PCR)-based genomic screen. A critical step in this process is the isolation of high molecular weight genomic DNA from Sabal yapa leaf tissue. A phenol-isoamyl-chloroform-based DNA extraction protocol was tested using 2 different methods of tissue homogenization: mechanical blending (Procedure 1) and manual crushing (Procedure 2). DNA extractions from SDS-treated lysates and non-SDS lysates were conducted followed by ethanol precipitation. It was concluded from the results that Procedure 2 was more effective in extracting a higher yield and quality of DNA than Procedure 1. The manual grinding of the leaf tissues in Procedure 2 was more effective than the blending technique used to create the original homogenate in Procedure 1. Mechanical blending resulted in the shearing and degradation of the DNA, whereas manual grinding significantly reduced shearing and improved overall yield. This latter extraction method is therefore more suitable for isolating the high molecular weight genomic DNA required for an effective PCR screen.

P77 Circulating cell-free DNA in plasma versus serum of patients with Leukemic Cutaneous T-Cell Lymphoma

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Tumor DNA is found among circulating cell-free DNA (cfDNA) in patients with solid tumors as well as B-cell Lymphoma. Tumor specific cfDNA may be biomarkers for tumor diagnosis, prognosis or disease relapse monitoring. However, it is unclear whether serum or plasma serves as a better resource for obtaining reproducible cfDNA. The goal of this project was to compare cfDNA concentrations in serum versus plasma of patients with leukemic cutaneous T-cell lymphoma (L-CTCL). Plasma (n = 42) and serum (n = 50) were prepared from patients' fresh peripheral blood before (baseline) and after (day 2, 3 months and 6 months) extracorporeal photopheresis (ECP) treatment. ChargeSwitch gDNA extraction kit was used for cfDNA extraction. The concentration of cfDNA was quantitatively measured by High Sensitivity Assay on a Qubit 3.0 Fluorometer. The average concentration of cfDNA in plasma (2.6ng/mL) was about 12.9-fold lower than serum (32.3ng/mL). There was an approximately 3.5-fold increased cfDNA in plasma (8.64ng/mL) at Day 2 post ECP treatment compared to baseline (2.47ng/mL), which may indicate the release of cfDNA from apoptotic L-CTCL tumor cells. However, we did not see a clear correlation between cfDNA concentrations (in either plasma or serum) and tumor cell counts. Our results suggest that plasma may be a stable resource of obtaining

cfDNA. Tumor specific genes will be assessed using these extracted cfDNA in future studies.

P78 African Americans with Pancreatic Ductal Adenocarcinoma Exhibit Gender Differences in Kaiso Expression.

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Kaiso, a bi-modal transcription factor, regulates gene expression, and is elevated in breast, prostate, and colon cancers. Depletion of Kaiso in other cancer types leads to a reduction in markers for the epithelial- mesenchymal transition (EMT), however its clinical implications in pancreatic ductal adenocarcinoma (PDCA) have not been widely explored. PDCA is rarely detected at an early stage but is characterized by rapid progression and invasiveness. Herein, we report the significance of the subcellular localization of Kaiso in PDCAs from African Americans. In the overall patient population we observed a higher expression of cytoplasmic Kaiso in high-grade pancreatic tumors compared to low-grade pancreatic tumors ($P = 0.0435$). Kaiso expression was higher in the cytoplasm of invasive and metastatic pancreatic cancers ($P < 0.0001$). In males, cytoplasmic and nuclear expression of Kaiso correlated with cancer grade and lymph node positivity ($P = 0.0013$; $P = 0.0112$ and $P = 0.0177$, respectively). In male and female patients, cytoplasmic Kaiso expression correlated with invasiveness ($P = 0.0101$). Further, analysis of the largest PDCA dataset available on ONCOMINE shows that with increase in Kaiso expression, there is an overall increase in Zeb1, which is the inverse for E-cadherin. Hence, these findings suggest an oncogenic role for Kaiso in the progression of PDCAs, involving the EMT markers, E-cadherin and Zeb1.

P79 Foxi3 Ablation Retards Bone Derived Prostate Cancer Cell Growth

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Prostate cancer is the abnormal growth of cells in the prostate gland and studies have shown that 100% of men that die from prostate cancer have bone involvement. Of the many cells resident in the bone, myeloid cells secrete various soluble factors that contribute to the high turnover rate of cells and molecular processes of bone development. Of particular interest, Foxi3, a forkhead family transcription factor is critical in bone development and embryogenesis. However, its role in prostate cancer, has not been explored. Therefore, we hypothesized that Foxi3 is a key factor in promoting prostate cancer progression to the bone and its expression is modulated by FGF8. To investigate the clinical role of Foxi3 and study the effect of FGF8 on Foxi3 high expressing cells (PC3 and C42b), we analyzed its expression and function in human prostate cancer tissue and cell lines with or without FGF8 treatment. A significant increase in Foxi3 expression as cancer becomes more aggressive is identified in human specimens ($p<0.01$). Immunohistochemical analysis demonstrated a significant association of Foxi3 expression with tumor grade ($p<0.05$) and pathology ($p<0.01$). Further, C42b cells treated with FGF8 presented an 83-fold increase in Foxi3 expression and a significant increase in migration and proliferation rate ($p<0.001$). Interestingly, Foxi3 inhibition (si-RNA-Foxi3) in PC3 and C42b cells, significantly decreased cell proliferation and migration ($p<0.01$), even in the presence of FGF8. Together, our findings illustrate a synergistic oncogenic role of Foxi3 and FGF8 in promoting prostate cancer bone metastases.

P80 Identification of Translation Regulators that Control Sensory Neuron Function in *Drosophila melanogaster* larvae

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Nociception refers to detection of noxious mechanical, chemical, or thermal stimuli by specialized somatosensory neurons. The multidendritic class IV neurons required for nociception in *Drosophila melanogaster* larvae. Activation of these sensory neurons produces quantifiable nociceptive behavior that has been coined Nocifensive Escape Locomotion. Our goal is to define the regulatory pathways that control expression of the genes associated with the nocifensive response and sensory neuron function- namely those regulatory pathways that control translation of proteins required for nociception. We have conducted a genetic screen for nociception-defective phenotypes and found that genes encoding the translation initiation factors eIF3GA, eIF4E3, eIF4G2, and eIF2a are required in normal detection of a noxious thermal stimulus. These results suggest that proteins required for the transduction of noxious stimuli are regulated on a translational level in the sensory neurons. We are continuing to conduct thermal and mechanical nociceptive behavior assays on *Drosophila* larvae that have altered function of these translational regulators through cell-specific overexpression or RNA interference to determine the specific aspects of nociception that require these factors. These nociception behavior assays and future experiments will shed light upon the role that translation initiation factors serve in nociceptive behavior in *Drosophila* and the underlying molecular processes that may be responsible. Defining the regulatory pathways that control translation in sensory neurons will further our understanding of neural gene expression regulation of sensory transduction.

P82 The Effects of HIV-TAT And Morphine on M17 Neuroblastoma Cells

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Introduction: Parkinsonism has been reported in case studies of HIV/AIDS, and alpha-synuclein (asyn), involved in Parkinson's disease pathogenesis, is higher in postmortem HIV patient brains. Many HIV/AIDS patients take chronic opiates for pain, and recent evidence indicates combined treatment with the opiate morphine and the HIV protein Tat exacerbates neurotoxicity. Whether morphine +/- Tat regulates asyn metabolism and autophagy lysosome pathway (which mediates asyn clearance) markers in HIV/AIDS is unknown. Objective: The objective of this study is to determine if morphine +/- Tat regulates cell viability, levels of endogenous asyn/ALP markers, or clearance of over-expressed asyn. Methods: M17 human neuroblastoma cells were used that conditionally over-expresses human wild-type asyn, and were treated with HIV-Tat (100nM) +/- morphine (0-500μM). Cell viability was measured via MTT assay, while western blot analysis assessed levels of endogenous asyn, LC3II (autophagosome marker) and p62 (ALP substrate), as well as clearance of over-expressed asyn. Results: We observed that morphine induced cell death at ‰¥100μM, and Tat did not affect viability in the presence or absence of 500nM morphine. Western blot analyses suggested reductions in endogenous asyn, LC3II and p62 with 500nM morphine ± 100nM Tat. However, 500nM morphine did not affect clearance of over-expressed asyn. Discussion: It appears that M17 cells are less sensitive to Tat + morphine than cultured neurons, though previous studies have indicated that glial cells are important for mediating Tat + morphine toxicity. Western blot results suggested that 500nM morphine + Tat induced ALP function. Ongoing studies will determine the effects of higher morphine

concentrations on Tat-induced toxicity of M17 cells, and whether glial cells are important for eliciting these effects.

P83 Investigation of the Cytotoxicity of Soursop Pulp Extract on Hep-G2 Cells
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Annona muricata is a part of the Custard-Apple plant family originating in the tropical biomes of North and South America. Its fruit, soursop, has become popular in the Bahamas for its potential chemotherapeutic properties and has been regarded as an alternative treatment for inducing apoptosis in breast, lung, and colon cancer cells. However, research is limited regarding these claims. This study investigates soursop's possible cytotoxic effects on hepatocellular carcinoma cells. Cultured Hep-G2 cells will be exposed to varying amounts of soursop pulp extracts for a 24-hour period. A lactate dehydrogenase assay will be used to examine any cytotoxic effects of the extract. Preliminary research suggests that soursop extract does exhibit cytotoxic effects on Hep-G2 cells. Further characterization of the fruit extract can serve as a foundation for future investigations into which components of the extract may underlie its potential cytotoxicity.

P84 The Pattern of *Wolbachia* Infection in Insect Populations Native to Savannah, GA
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Wolbachia is the most common bacterial endosymbiont of insects. In the fall of 2013, Armstrong State University implemented a new curriculum wherein introductory biology students collect insect samples, identify to order using a dichotomous key, and extract genomic DNA for analysis through PCR and gel electrophoresis for *Wolbachia* infection. These *Wolbachia*-infected samples require verification: specifically the genomic DNA is re-analyzed for *Wolbachia* infection and additional PCR products are sequenced to verify the students' insect identifications. To date, approximately 500 DNA samples have been verified. These data now populate a database that has been designed to clearly present the prevalence of *Wolbachia* infection in the local insect populations of Savannah, Georgia. Providing a reliable source of information to determine the local patterns of *Wolbachia* infection will allow future student researchers to analyze the underlying natural phenomena that have shaped the spread of *Wolbachia* infection in the area. This verification process has also provided evidence to support curricular changes that have improved student success, such as refinements to the dichotomous key.

P85 DIO2 Expression in Myoblast Cell Lines Under Inflammatory Conditions
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A group of peroxidase enzymes, deiodinases, plays a role in the instigation and inhibition of thyroid hormones and thereby regulates human metabolism. It has been found that certain pathologies may affect deiodinase expression in mammalian tissues. One such ever-more prevalent pathology, obesity, induces chronic local inflammation in muscle tissue and may affect thyroid hormone regulation. Previous research has not extensively explored the connection of inflammation in muscle tissue and thyroid hormone regulation, and has failed to show a clear linkage in

deiodinases expression in muscle tissue under inflammatory conditions. We propose to search for a connection between muscle tissue under inflamed conditions and thyroid hormone regulation. This will be done by examining changes in expression of a certain deiodinase enzyme, deiodinase 2 (DIO2), at the mRNA level when differentiated C2C12 myoblast cell lines as well as ex vivo mouse muscle cultures are exposed to inflammatory treatments of interleukin-6 (IL-6). If a connection can be made between thyroid hormone regulation and muscle tissue inflammation, then further research and exploration may perhaps discover methods to maintain thyroid hormone regulation in muscle tissue at a normal in an obese individual.

P87 The Structural Evolution of Butterfly Egg Mimicry within the Passionflowers (*Passiflora* L.)

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Passiflora, also known as Passionflowers, contains approximately 550 species and is one of the most widely cultivated genera of flowering plants. The flowers of Passiflora attract an immense range of pollinators. Bats, hummingbirds, and bees are part of this diverse following. In addition, Passiflora displays extrafloral nectaries located on leaves and stem that attract ants, beetles, and wasps. Of all the insect visitors associated with the genus, Heliconius butterflies have a well-documented ecological relationship with Passiflora. Heliconius species oviposit on the leaves of Passiflora and the caterpillars emerge and feed on the plant, often completely defoliating it as a result. To combat this, Passiflora has evolved specialized egg mimic structures that deter gravid butterflies from laying their eggs on the leaves. While this is a famous example of coevolution, relatively little is actually known about the egg mimics themselves. Therefore, the current study seeks to examine the nature of the egg mimics using anatomical, developmental, and morphoglcial data. The following types of egg mimics were investigated: flowers (P. arbelaezii), leaf blade (P. allantophylla), leaf teeth (P. berteroana), stipules (P. cyanea), leaf apex (P. poslae), and petiole (P. triloba). Scanning electron microscopy was employed to examine both ultrastructural and developmental details of the egg mimics. Paraffin embedded samples were sectioned to observe anatomical differences among the structures. The egg mimic structures were predominantly located on vegetative structures, though floral tissue produced egg mimics in P. arbelaezii. Passiflora arbelaezii had normal bud progression; however, the anthers lacked pollen and aborted prior to coronal development. The distinct anatomical and morphological differences observed within each type of egg mimic suggests at least six independent evolutionary origins of egg mimics in Passiflora. Selective pressures for reduction in predation may have been a driving force in the evolution of these structures.

P88 *Wolbachia* infection frequency and evolution among mosquito (Culicidae) species

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James Russell

Wolbachia bacterial infections among tropical mosquito species have been found to reduce the transmissibility of mosquito-vectored human diseases, such as dengue; raising the possibility of biological applications to decrease the spread of zoonotic diseases. Understanding the frequency and basic biology of Wolbachia infections among mosquito species is an important step in this endeavor. We have collected

mosquito samples from several sites across metro Atlanta and identified them to species using morphological keys and molecular DNA barcoding protocols for mitochondrial gene regions. Wolbachia infection status using a PCR protocol for a 16s ribosomal gene sequence specific for Wolbachia has been used to identify infected mosquito samples. Wolbachia 16s and mosquito mitochondrial genes have been sequenced and subjected to phylogenetic analysis. Our preliminary results suggests Wolbachia can impact mitochondrial genetic diversity in infected species.

P89 Developing a system to study the compilospecies concept

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Matt Estep

A compilospecies is defined as a genetically aggressive taxa that "steals" or incorporates the genomes of other taxa via introgressive hybridization. This concept was first defined within three genera of the bluestem grasses; *Bothriochloa*, *Capillipedium*, and *Dichanthium* (The BCD clade). Within this clade, Bothriochloa bladhii, was identified as the compilospecies that has hybridized with other species within and between genera of the BCD clade. Proper cytological techniques and accurate chromosome counts are needed to begin preliminary investigations to understand the mode of hybridization and to track "dominant" genomes. Our goal is to develop reliable methods for the preparation of meiotic chromosome spreads using a combination of classic aceto-orcein squashing methods and new modified drop methods. Meiotic tissue was harvested from greenhouse grown BCD clade grasses from August to November of 2016 and fixed in either Carnoy's fixative or paraformaldehyde. Preliminary results will be presented.

P90 Description and Geography of a Unique Population of the Stonecat (*Noturus flavus*)

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The Stonecat, *Noturus flavus*, has one of the largest distributions among madtom catfishes, ranging latitudinally from northern Alabama to southern parts of Canada and longitudinally from Montana to Vermont. Corresponding to this widespread distribution are unique patterns of morphological variation. Several reference works suggest the existence of three distinct morphs of Stonecat which may warrant independent, species-level designations. In this project we evaluated morphological (shape and pigmentation) variation of the Stonecat across its entire range (n=453). Particular emphasis was placed on the morph found throughout the upper Cumberland River and Tennessee River drainages, herein referred to as the "Highlands Stonecat" . Sheared Principal Component Analyses indicated only moderate divergence in morphometric characteristics of the Highlands Stonecat versus typical Stonecat. However, pigmentation patterns were markedly different between the two putative lineages and specimens were 100% distinguishable when two or more pigmentation patterns were compared concurrently. Distinctive light-colored crescents were present on the nape of 99% of Highland Stonecat specimens, 91% showed dense pigmentation on the lips, and 73% displayed moderate pigmentation on the pelvic fins and abdomen. In contrast, only 3% of typical Stonecat specimens had crescents present on the nape, 6% showed pigmentation on the lips, and 21% had pelvic find and/or abdomen pigmentation. Our morphological results corroborate those of recent karyologic and phylogenetic studies suggesting the Highlands Stonecat is a distinct lineage of Stonecat in the

formal taxonomic sense. Thus, we suggest future efforts be directed toward formally describing the Highlands Stonecat as a unique species of madtom catfish.

P91 A Comparison of Two Contact Calls Produced By Hatchling Chinese Blue-breasted Quail (*Coturnix chinensis*).

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Chinese Blue-breasted Quail chicks (*Coturnix chinensis* - Galliformes) are known to produce two different contact calls (A call, B call) that appear to function in precocial family cohesiveness. Breeding pairs are territorial and the young are well-developed at hatching - permitting them to explore new areas with their families soon after leaving the egg. Contact calls keep the young within the vicinity of their parents. The one-syllable A call has been studied and its spectral properties analyzed. However, the two-syllable B call has not been previously investigated, and it is unknown whether this call is a longer version of the A call or a different signal entirely. In addition, it is unclear if the B call is one syllable repeated, or if it is composed to two acoustically different notes. Vocalizations were digitally recorded from hatchlings that were removed from the incubator and placed in a brooder. Seven spectral properties of the A-call (one syllable) and B-call (two syllables) were measured: call length (sec), low and high frequency (Hz), center frequency (Hz), frequency width (Hz), and two amplitude elements (average and maximum power, dB). The results indicate that the two syllables of the B call are significantly different in three important variables, so it is not one syllable repeated. The single-syllable A call is statistically different from the first and second syllables of the B call in most of the variables measured, so these signals are acoustically distinct.

P92 Phylogenetic relationships of 13 species in Emberizidae (Aves, Passeriformes) based on complete mitochondrial genome

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Emberizidae, one of the largest families of Passeriformes, is characterized by many morphologically similar species and, therefore, historically controversial taxonomic status. To better resolve the phylogenetic relationship of Emberizidae, we sequenced the complete mitochondrial genome of Emberiza leucocephala (Pine Bunting; 16754 bp in length) and E. elegans (Yellow-throated Bunting; 16780 bp in length). We obtained complete mitogenome data from GenBank for 11 additional Emberizidae species representing Emberiza, Latoucheornis, and Melophus. Complete mitochondrial genomes were used to reconstruct the phylogeny of 13 species based off of Maximum Parsimony (MP) and Bayesian Inference (BI). MP and BI trees were similar with the exception of E. spodocephala (Black-faced Bunting) and all nodes were supported with values greater that 50%. E. cioides (Meadow Bunting), E. jankowskii (Rufous-backed Bunting), and E. leucocephala form a clade, with E. lecocephala having diverged earlier than E. cioides and E. jankowskii. Results also indicate that Latoucheornis siemsseni (Slaty Bunting) is nested within the genus Emberiza and forms a sister clade with E. elegans. Additionally, calculated genetic distances indicate that the Melophus lathami (Crested Bunting) is more closely related to Emberiza than previously suspected (maximum p-distance = .120). Our results are concordant with previous studies and question the classification of Melophus and Latoucheornis as monotypic genera and suggest they be placed within Emberiza.

P93 The architecture of genomic cohesion among locally adapted *Helianthus annuus* (Common Sunflower) populations

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In nature, environmental heterogeneity across species' ranges is ubiquitous, particularly in widely-distributed species. To persist across disparate environmental conditions, intraspecific populations adapt to local conditions while simultaneously exchanging an amount of genetic material sufficient to maintain species cohesion. The resultant genome exhibits heterogeneity in levels of divergence across its length, where gene flow is stymied at loci under divergent selection but not at others. However, given the antagonistic nature of divergent selection and gene flow, the extent to which either can act within a single genome is limited. We used a population genetic approach to examine the genomic architecture associated with this tension. RNAseq data were collected from adult *Helianthus annuus* grown in a common garden, and aligned to a de novo-assembled reference. Transcriptome-wide patterns of divergence were characterized using estimates of nucleotide diversity (π), absolute divergence (d_{xy}), Φ ST and Tajima's D. We leveraged estimates of divergence statistics (d_{xy} and Φ ST) against patterns of haplotypic diversity described by Tajima's D and π to infer the direction (i.e., divergent or uniform) and mode (i.e., directional or balancing) of selection acting on each transcriptomic region. De novo-assembled transcriptomic elements were then back-mapped to the *H. annuus* genome to further investigate the spatial organization of divergence. From this, we present a characterization of the genomic architecture underlying intraspecific local adaptation.

P94 *Liatris* (Asteraceae): A Model System for the Study of Niche Evolution

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How organisms diversify across heterogeneous environments remains a major question in evolutionary biology. Niche divergence has been found to be a crucial component of this process. The flowering plant Liatris (blazing star, Asteraceae) is an ideal clade to use as a model for investigating niche evolution, as it comprises 37 species that occur in a diverse array of habitats, including prairies, marshes, and stone outcrops, and tend to be ecologically isolated. The genus also includes hybrids and polyploids, which affords the opportunity to investigate how hybridization and polyploidization can affect niche evolution. My work aims to elucidate phylogenetic relationships and patterns of niche evolution within Liatris, and how this process may have been shaped by hybridization and polyploidization. To resolve the phylogeny, a targeted capture/enrichment approach will be utilized to acquire large amounts of genomic sequence data. Nuclear loci will be targeted using MyBaits probes designed by Mandel et al (2014). These data, in conjunction with off-target chloroplast loci, will be used in phylogenomic analyses. Chromosome counts and flow cytometry will be conducted to inform polyploid evolution. Publicly available ecological data and digitized herbaria records are being used in Maxent to develop niche models. Niche models are already being assessed for niche overlap and differentiation. My preliminary analyses suggest that niche differentiation has occurred, even among presumably closely related species. The ancestral niche state for the genus will be reconstructed to elucidate the patterns of niche evolution. This work will increase our understanding of how these aspects of biology can affect speciation and niche evolution patterns within a group of closely related species, and will help elucidate how the diversity we see today may have arisen.

P96 Are College Students' Involvement in Extreme Sports Correlated With Their Genotype?

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Risk taking behaviors, such as engaging in drug use or extreme sports is thought to be controlled in part by ones personality. Serotonin is a neurotransmitter responsible for affecting mood and social behavior. Interestingly, different levels of serotonin are correlated with personality traits such as reward dependence, novelty seeking, and harm avoidance. Harm avoidance appears to influence ones willingness to engage in risk taking activities such as extreme sports. Harm avoidance is defined as being pessimistic, overly worried, becoming easily fatigued, and being shy, fearful, and doubtful. Because harm avoidance is correlated with serotonin levels, it is possible that varying levels of serotonin may influence an individual's risk taking behavior. Alterations in serotonin levels found in the synapse can be due to either increased expression and release of serotonin or how fast serotonin is cleared from the synapse by serotonin transporters. The gene-linked polymorphic region 5-HydroTryptamine Transporter Gene-Linked Polymorphic Region (5-HTTLPR) is considered to have an influence on human behavior. 5-HTTLPR is a functional polymorphism in the 5' promoter region of the serotonin transporter gene SLC6A4. The most common 5-HTTLPR polymorphisms are composed of either a fourteen or a sixteen copy of a 22 bp variable nucleotide repeat sequence (VNTR) termed the "S" allele or the "L" allele, respectively. The "S" variant decreases the amount of transcription, which effectively increases serotonin levels found in the synapse. In contrast, the L allele has the opposite effect. In previous studies, the "S" allele correlated with an increase in harm avoidance. Our study is investigating whether or not college students from Georgia Gwinnett College show correlations between willingness to engage in extreme sports and their harm avoidance score. Additionally, we will present data on correlations between an individual's genotype for 5-HTTLPR and level of harm avoidance and participation in extreme sports.

P97 An Experimental Strategy for Identification of Novel Myosin genes in *Sabal Palms*

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Movement is one of the defining characteristics of all living organisms. Many forms of movement within biological systems are powered by the activity of enzymatic motor proteins. Myosins are a superfamily of molecular motors that catalyze an ATP-dependent interaction with actin filaments, generating chemo-mechanical force. In plants, 3 classes of myosins are known to exist: classes VIII, XI and XIII. Higher plants contain primarily VIII and XI myosins, while class XIII is found in algae. Myosins have been detected in several organisms such as tobacco, lily, pea, tomato and maize, and some members have been shown play pivotal roles in cellular processes such as bulk transport, cytoplasmic streaming and organelle positioning. Although several members of the myosin superfamily have been identified, functional designations are significantly lagging. Further, myosin genes have yet to be identified in Sabal palms (although they are presumed to exist). The principal goal of this study is the identification and characterization of unconventional myosin genes in Sabal palm species. Towards this end, the investigation will focus on the following experimental objectives: Identification of myosin heavy chain genes using a Polymerase Chain Reaction (PCR)-based screen of Sabal palm genomic DNA. Degenerate primers targeting conserved

regions of the motor domain will be used to generate myosin-specific amplifications. Molecular cloning of amplified gene fragments using recombinant DNA technology. Characterization of conserved regions of myosin genes by DNA sequencing. Classify newly indentified gene sequences and construct intra-class phylogenetics using bioinformatic applications. It is anticipated that this study will yield new genes as members of the myosin superfamily.

P98 Development of SSR markers for *Chresta* (Asteraceae, Vernonieae) using genomic data

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Jennifer Mandel

Chresta is a small genus of Asteraceae, almost endemic to Brazilian Cerrado and Caatinga. Despite the small number of species, the genus presents high morphological variation that raises interesting evolutionary questions. Four of the 15 species occur in the semi-arid Caatinga region, growing directly over quartzitic or granitic rock outcrops that are isolated from each other and spread apart in a semi-deciduous forest matrix. Three of these species present similar morphological features, which sometimes overlap. Populations in the extremes of the distributions present different morphologies from those found in the "core" populations. This variation led to the acknowledgment of some populations as different species, such as *C. hatschbachii*, which was segregated from *C. harleyi*. In the present work, we used genomic data previously obtained by the sequencing of approximately 1000 nuclear markers from four samples and the whole chloroplast sequence from seven samples to design SSR markers that present variation among the three Caatinga species and among individuals from the same species, which will be later used to assess genetic diversity. The chloroplast sequences of seven *Chresta* were aligned using MAFFT, and the SSR finder Phobos was used to locate possible repeat regions, which were then selected based on putative differences in size among the seven sequences. The nuclear markers were assembled in HybPiper and the alignments for each locus were individually searched with Phobos. Also, contigs assembled with Spades were searched with Phobos and contigs with possible candidates were then blasted in GenBank to guarantee they were not chloroplast sequences. Nineteen pairs of primers were developed, twelve from nuclear markers and seven from chloroplast, and tested. Most of them amplified with all species using the same PCR program and fragment analysis shows some variation both among species and among individuals of the same species.

P99 Relationship between *Wolbachia* infection frequency and mitochondrial variation in introduced populations of the brown widow spider.

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The brown widow spider (*Latrodectus geometricus*) is an invasive species thought to have originated in South Africa, but has been introduced to every continent except Antarctica. In the United States, *L. geometricus* was introduced into southern Florida in the 1930's, but a significant range expansion was documented in the last two decades. The range currently extends north to South Carolina and west to Texas. *Wolbachia pipentis*, a bacterial endosymbiont, was recently detected in the brown widow. *Wolbachia* is a bacterium that lives within host cells, is maternally inherited, and often has reproductive effects on its arthropod host that drive increased frequency of the bacteria in host populations. Considering that both *Wolbachia* and mitochondria are maternally inherited, there is an opportunity for an interaction or linkage to evolve between the two. The purpose of this study is to

determine if *Wolbachia* frequency and diversity of mitochondrial DNA (mtDNA) has changed over time in two brown widow populations. DNA was sampled from spiders collected from a Georgia population during two time points (2013 and 2016) and a Louisiana population during three time points (2006, 2009, and 2013). *Wolbachia* was detected by PCR using *Wolbachia* specific primers and the mitochondrial COI gene was sequenced from each individual spider. Differences in mtDNA haplotype frequency over time were tested using Analysis of Molecular Variance (AMOVA). The three time points for Louisiana showed significant genetic differences, while the Georgia samples showed no significance difference in haplotype diversity between time points. There was also an increase in *Wolbachia* frequency in the Louisiana population over time, but not in the Georgia samples. Our results suggest that a correlation exists between *Wolbachia* infection and mtDNA diversity in Brown Widow spiders. This pattern may be the result of historical or current hitchhiking between *Wolbachia* and mitochondrial genotypes.

P100 Mapping and annotation of lncRNA transcripts expressed in rat muscle tissue using a Tuxedo Tools pipeline

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In recent years, long noncoding RNAs (lncRNAs) have been explored as a previously unknown source of regulation in gene expression. Researchers have investigated lncRNA expression levels and found that these sequences may be essential to certain biological processes such as protein scaffolding, cell division, and transcriptional regulation. We believe lncRNAs may also play an important role in the translational regulation of protein in relation to muscle atrophy. We analyzed RNA transcripts harvested from rats during a hind limb suspension experiment, a procedure in which the rat is suspended by its tail in order to allow the weight to be placed on the front limbs while the hind limbs atrophy. Control animals were not exposed to this treatment. We compared these RNA transcripts to the *Rattus norvegicus* genome using the Tuxedo Pipeline, a series of computer programs used to map sequences to a genome. The programs used in the pipeline are run from the Unix command line and align the RNA sequences to a genome, analyze the sequences to locate splice junctions, and assemble transcripts in order to find the relative abundances. The programs were used to assess the differential expression of lncRNA sequences involved in the regulation and differentiation of muscle tissue. Further, we will discuss analyses conducted to identify differentially expressed genes as lncRNAs. The identification of novel lncRNAs and their locations in the rat genome will assist in determining mechanisms of regulation in protein synthesis and cell differentiation contributing to muscular diseases.

P101 Comparison of Efficacy of DNA from Feathers and Liver Tissue for the Molecular Sexing of Hawk Species

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Joanna Katsanos

Unlike many other species of birds, raptor species, including hawks, do not display sexual dimorphism. As a result, a molecular sexing protocol is necessary to accurately determine sex which has many important applications including field research and breeding programs. In birds, females the heterogametic sex with one Z chromosome and one W chromosome, while males are homogametic with two Z chromosomes. A different size of the CHD1 gene has been found on each of these chromosomes. This allows birds to be sexed molecularly since males will only display the CHD1Z gene, while females will display both the CHD1W gene and the

CHD1Z gene. This research aims to develop a consistently effective protocol for molecularly sexing hawk species found near Charlotte, NC using blood and tissue samples including feathers. While, in the past, blood and other tissues have been shown to be a better source of DNA, feathers could also be a very useful source of DNA if a functional protocol can be developed since they can be accessed noninvasively while birds are alive. DNA will be isolated from liver and feather samples using a Qiagen DNeasy kit. Concentrations and purity of DNA isolated from both sources will be compared. The CHD1Z and CHD1W genes will then be amplified using a PCR reaction involving 2550F and 2781R primers and a multiplex PCR reaction involving 3007F, 2987F, and 3112R primers. These primers have been shown to have differing, inconsistent success levels with various raptor species. The sex of the birds will then be determined based on the amplified CHD1Z and CHD1W genes using gel electrophoresis. Bands from both DNA sources will be compared to determine if feather DNA garners comparable results to liver DNA.

P102 Evaluating Mutagenetic Effects of Yellow Dye #5 on Eukaryotic Cells

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Different types of azo dyes derived from coal tar are US Food and Drug Administration (FDA) approved and widely used as food colorings in artificial or processed foods. These dyes are often found in foods such as soft drinks, juices, and sauces. These dyes are also used in products not meant for consumptions such as shampoos, cosmetics, colognes, lotions, and toothpastes. There is controversial evidence regarding the safety of these dyes. In many instances their safety has been questioned and several of these dyes which include FD&C Yellow #5 also known as tartrazine and FD&C Red #40 has been implicated in increasing allergies and hyperactivity in children. Recent studies have provided inconclusive evidence that some of these food dyes are mutagenic when the Accepted Daily Intake (ADI) limit is approached or surpassed. The constant exposure to artificial dyes makes the ADI difficult to accurately quantify. Alarmingly, the American per capita consumption of these dyes is close to five pounds, which is double the amount of 20 years ago. Due to the immense growth of tartrazine exposure and intake, our goal with this study was to ascertain the mutagenic affects of different concentrations of yellow dye #5, tartrazine in eukaryotic cells. The eukaryotic cell model, *Saccharomyces cerevisiae* and the reversion of the *lys2deltaA746* allele by fluctuation analyses were used in this study. Varying concentrations of dye solutions were made from powder aluminum lakes. Yeast samples were treated with increasing concentrations, and then assessed for reversion of the lys2deltaA746 allele. Initially, no significant difference was detected when comparing the number of *lys2*-mutated colonies isolated from control or treated cultures. The ability for tartrazine to induce mutagenesis in repair-compromised yeast will also be presented.

P103 Development of microsatellite markers for diversity studies within the genus *Dicentra*.

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Matt Estep

The genus *Dicentra* (Fumariaceae, Bernhardi 1833) is a small group of herbaceous plants containing seven species found in North America and one species found in eastern Asia. Three species; *D. eximia*, *D. cucullaria*, and *D. canadensis* display an interesting polyploid series in the Southern Appalachians, where *D. eximia* is a diploid (2N=16), *D. cucullaria* is a tetraploid (2N=32) and *D. canadensis* is a octoploid (2N=64). In order to examine genetic diversity and

species boundaries within the polyploid series, microsatellite markers were developed. DNA from *D. cucullaria* was sequenced on an illumina sequencer, resulting in 533,116 sequences. These sequences were searched for microsatellite motifs using MSATcommander software. We identified 10,717 microsatellite motifs within the sequence data and designed primers for 50 loci. Primer pairs were screened against seven DNA samples from *D.cucullaria* or *D. canadensis*. Seventeen of the fifty primer pairs successfully amplified a single locus based on 1% gel electrophoresis. These primers will be used to fluorescently label PCR products for fine resolution separation on an ABI3730 sequencer. Results of the initial screen will be presented.

P104 *Nyctiellus lepidus* population structure in the Grand Bahamas Bank

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David Reed

Nyctiellus lepidus, commonly known as Gervais's Funnel-eared Bat, is a species of small insect-eating bat found on several islands in The Bahamas and Cuba. My project examines the relatedness of *N. lepidus* populations located on Long Island, Cat Island, and Eleuthera in The Bahamas. Cat Island is separated from Long Island and Eleuthera by deep water channels while Long Island and Eleuthera are further apart but connected by the Exumas, a shallow water chain of small islands. In order to assess genetic relatedness, DNA was extracted from samples from bats on each of the islands (n=10 for Cat Island, n=10 Eluthera, n=10 Long Island) in the form of wing biopsies (n=20) or organ tissue (n=10) for genetic analysis. PCR amplification was run with primers for Cytochrome b gene and five microsatellite markers. Sequencing for Cytochrome b was run on Illumina NextSeq and the microsatellites were genotyped by Illumina MiSeq. All sequence data was analyzed using Geneious. The cytochrome b analysis showed some gene flow or connectivity between the population on Eleuthera and Long Island while Cat Island was more isolated. Preliminary results from the microsatellites suggest that the *N. lepidus* colonies on these three islands form one homogenized population. These data indicate the populations of Eleuthera and Long Island are more closely related to one another, which suggests that *N. lepidus* are more likely to fly longer distances over shallow water and small islands than shorter distances over deep water channels. This suggests that we look more closely at deep water channels as barriers to gene flow and dispersal on islands, especially those in The Bahamas.

P105 Barcoding Metro Atlanta Birds

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Jill Penn, Mia Malloy, Maribel Fernandez

The traditional approach for identifying species has been to observe morphological characteristics described in dichotomous trees. Over the past decade a new method for identifying species has been growing in popularity- DNA barcoding. In addition to nuclear DNA, animal cells contain mitochondrial DNA which codes for a number of metabolic genes. One gene in particular, cyctochrome-c-oxidase-1 (CO1) has been used extensively as a barcode for species identification. It has been found that CO1 sequence variability between species is 10-20 times greater than variability within species. Over 150,000 animal species have been barcoded, but the total numbers of individuals sequenced for many species is often low. We have isolated DNA from molted feathers collected from various locations in the Metro Atlanta area. The CO1 gene was PCR-amplified, sequenced, and analyzed for 10 avian species for comparison within and between species.

P106 Where we Spent Our Winter Break: Historical Biogeography of Insular White-footed Mice ("Peromyscus leucopus") in Eastern North America

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The hypothesis of previously unsubstantiated northeastern glacial refugia in the vicinity of George's and Brown's Banks, which could have served as colonizing sources of extant northeastern insular populations, was tested using combined morphological, mtDNA, paleo-climatological/vegetational, and geographical data sets. Systematic analyses were conducted on 23 populations of "Peromyscus leucopus" representing the eastern North American range of the species. Variation in the mtDNA control region was analyzed in 99 individuals representing 23 populations (nine insular, 14 mainland) from Nova Scotia to Georgia. Phylogenetic and Network analyses were conducted using 895 bp of mtDNA control region to assess genetic variation within and among northeastern insular and eastern coastal mainland populations. Among populations sampled, 59 haplotypes were identified of which 26 were endemic to insular populations. Although there is limited evidence for phylogeographic structuring, interdigitation of haplotypes among populations suggests recent interchange of mitochondrial lineages. Mismatch distribution of pairwise haplotype frequencies indicates recent expansion for mainland populations, and a pattern of allopatric stability for insular populations. Interpretation of combined data sets does not support the hypothesis for existence of northeastern Pleistocene glacial refugia, in the vicinity of George's and/or Brown's Banks, as colonizing sources for extant northeastern insular populations. Phenotypic and nucleotide sequence divergences among contiguous mainland populations reveals clinal differentiation resulting from late Wisconsin/Holocene northward migration along the coastal mainland and emergent coastal plain from southeastern United States Pleistocene (Wisconsin) refugia. Insular populations are Holocene coastal plain relicts, isolated by vicariance on topographic high spots that became islands in the northeast. Differentiation of insular populations is the result of a combination of genetic drift due to initial founding events and subsequent lack of gene flow resulting from isolation by rising sea level, and localized insular phenotypic adaptation to variable environmental selective pressures during the Holocene.

P107 Determining the Genetic Relatedness of Various *Rosa* Plant Species by DNA Barcoding

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Malcolm Manners, Brittany Gasper

The lineage of the genus *Rosa* can be traced mostly to Asia with some species originating in North America, Europe, and Northern Africa. Over many years, roses from all over the world have been crossed to create new species and hybrids. As a result, many species have unknown origins. Some botanists believe that various species of roses are similar enough to be considered the same species resulting in ambiguity over the exact number of species. This study looked to understand the phylogenetic relatedness of eleven different species of roses currently found in North America. DNA barcoding was used to determine the genetic relatedness of the species. The two genes used for barcoding were the highly conserved *rbcL* gene, which codes for ribulose biphosphate carboxylase (RUBISCO), and *matK*, which codes for a plant plastidial gene whose protein function is to splice out introns. PCR amplified *rbcL* and *matK* gene fragments were sequenced and bioinformatically compared in order to accurately understand the relationship between the species. The sequencing results were used to generate a phylogenetic tree of the eleven species, the results of which will be discussed.

P108 Use of Methylobacterium as a Possible Protection against Pathogenic Infection in Red Clover, *Trifolium pretense.*

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Dr. John Davis

Bacteria of genus *Methylobacterium* are known to grow in the phyllosphere of clover being beneficial to the plants. Some species are known to form biofilms and be involved in nitrogen fixation and nodule formation. Others are known to produce phytohormones, interact with plant pathogens, promote plant growth and induce increased photosynthetic activity. In 2013, Yim *et al*., inoculated tomato plants with methylobacteria and challenged with *Ralstonia solanacearum*; it was found that methylobacteria increased defense enzymes in tomato plants by modulating the ethylene biosynthesis pathway. In that same work, plants that were treated with the *Methylobacterium* showed significantly reduced disease symptoms and lowered ethylene emission under greenhouse conditions. The use of these bacteria as biocontrol agents should be further studied. I am conducting experiments investigating the effectiveness of *Methylobacterium* against disease in red clover plants. Red clover is an important agricultural crop, and the relationship between *Methylobacterium* and a pathogen with red clover has not been studied. It is possible that the *Methylobacterium* are beneficial to numerous plant species and a better understanding of how these bacteria interact on the clover phyllosphere could lead to higher crop yields. Since *Methylobacterium* frequently colonize clover, it can be isolated from clover grown outdoors. After isolating wild strains of *Methylobacterium* from clover grown outdoors, clover plants will be grown in a growth chamber in the lab. The seeds, roots and leaves of the plants at different growth stages (at time of planting, after germination, when leaves have developed) will be inoculated with the isolated bacteria or remain sterile as a control. The disease index will be calculated on certain days for the clover plants grown in a growth chamber. I hypothesize that pathogenic infection will be suppressed by *Methylobacterium* because it is known to increase plant defenses.

P109 Culturing the Unculturable: Observing the Growth of Marine Bacteria Using Natural Sea Water Media

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Eric Warrick

This project tests various methods for culturing bacteria originally isolated from soil collected at local marine locations in the lab in order to identify novel bacteria with antibiotic production. As antibiotic resistance continues to rise worldwide, the push to discover new bacteria in hopes of countering this world health crisis is greater than ever. However, despite the exceptional number of bacteria in soil, growing and sustaining these microorganisms in the lab continues to be a major challenge because of the current inability to continuously cultivate the vast majority of bacteria present in the environment. This project attempts to mimic major components of the original environment of isolated bacteria to test the hypothesis that limiting the number of difference between the lab environment and the natural environment will allow for optimal conditions for growth of otherwise difficult to culture bacteria. This could provide insight on how we might better be able to culture novel bacteria in the lab to further progress toward combating antibiotic resistance. The first component tested and highlighted in this poster is the inclusion of natural sea water in agar prep in place of deionized water supplemented with 0.5M NaCl that is typically used. The sea water was collected from a single site, filtered to remove any visible debris, and sterilized during agar preparation. Multiple bacteria, previously isolated from soil at the sea water collection site, were then streaked on the sea water agar in addition to

other agar types. Colony growth and morphology were observed and compared with standard media prepared with deionized water supplemented with 0.5M NaCl, with results provided in this poster.

P110 Relationships between poultry farms and suspended bacteria in streams of the South Carolina Piedmont

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Greg Lewis, Min-Ken Liao, Dennis Haney, Kumar Mishra, Jocelyn Stalker

Previous studies provide evidence that poultry farms influence water quality in streams and rivers in some regions. In particular, farms may be sources of fecal bacteria and nutrients to streams. Chronic treatment of poultry with antibiotics may also lead to inputs of antibiotic-resistant bacteria from farms to water bodies. We examined whether chicken farms in the western Piedmont of South Carolina influenced the abundance of suspended bacteria in streams of the Upper Savannah River Basin. We hypothesized that the concentrations of both fecal indicator bacteria and total heterotrophic bacteria in small streams would correlate positively with the density of chicken houses in the streams' watersheds. During June-August 2016, under drought conditions, we collected water samples from 28 sites on first to third order streams. Land cover in the streams' watersheds ranged from mostly forested to mixtures of pasture, forest, and row crops. Chicken house densities ranged from 0 to 7.7 houses/km2. We measured concentrations of total coliforms and *Escherichia coli*, tetracycline-resistant total coliforms and *E. coli*, *Enterococcus*, and total heterotrophic bacteria. Water samples also were analyzed for turbidity, major ions, total dissolved nitrogen, and dissolved organic carbon (DOC). In simple bivariate correlations, concentrations of total coliforms and *E.coli* (including tetracycline-resistant coliforms and *E. coli*) correlated positively with chicken house density. However, after accounting for variation in watershed pasture cover with partial correlation analyses, these correlations were not significant. Concentrations of *Enterococcus* and total heterotrophic bacteria did not correlate significantly with chicken house density, but total heterotroph concentrations correlated positively with DOC concentrations. The drought conditions under which we conducted our study may have minimized impacts of poultry farms on bacteria concentrations. Additional research will be needed to better separate the influence of poultry farms and pasture on bacterial abundance in streams of this region.

P111 Characterization of a Novel Antibiotic-Producing Pigmented Marine Bacterial Isolate

Caitlyn Johnson, Florida Southern College, Biology Department, Lakeland, FL, 33801
Tara Trenhaile, Eric Warrick, Brittany Gasper

An antibiotic producing and red pigmented marine bacterium named marine isolate-3 (MI-3) was isolated off the Gulf Coast of Florida. Preliminary classification of MI-3 by 16s *rRNA* gene sequencing showed the organism is in the Zooshikella genus. To determine whether this marine isolate is a novel species of the genus Zooshikella, we have performed qualitative comparison of favorable growth conditions, utilized API strips for biochemical characterization, completed analysis of the fatty acid methyl ester composition of the membrane lipids (FAME analysis), and employed multi-locus sequence analysis (MLSA) to genomically profile the sample against the known species *Zooshikella ganghwensis* (strains 12044 and 12045) and *Zooshikella marina* (strain 42659). Data resulting from this study has shown our sample prefers the same NaCl concentration as the known species samples of *Zooshikella* and possesses the same major fatty acids in its composition. The API 20NE strips show MI-3 is most closely related to *Z. ganghwensis* (44) as they both

tested positive for gelatin hydrolysis, a process not noted in either the *Z. marina* or other *Z. ganghwensis* (45) sample. MLSA results supported the API strip analysis as *Z. ganghewensis* was determined to be its closest relative at 67% nucleotide similarity. Based on the results acquired, it cannot be completely determined whether MI-3 is a unique species of *Zooshikella* or a new strain of an existing species, but the data suggests it is at least a new strain within the genus *Zooshikella*. Future suggestions for experiments to achieve a species classification of MI-3 will be discussed.

P112 Classifying Coastal Bacterial Colonies Isolated from Sarasota Bay, Florida with Antimicrobial Activity

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Overuse of antibiotics has become a serious threat to medicine as many pathogens have become resistant to commonly used antibiotics. The aim of the Small World Initiative is to use our environment to find bacteria that can naturally fight off pathogens and identify them for possible use in medicine. Bacteria were isolated from Sarasota Bay and tested for antimicrobial activity against the ESKAPE-safe bacterial strains. The samples that produced an antimicrobial response to the ESKAPE-safe bacterial strains were then classified by DNA sequencing the 16s rDNA gene, gapA, rpoO, and rpoB. An electrophoresis gel was performed to ensure amplification of the targeted genes was successful during PCR. The amplified DNA samples were sequenced at Yale University and examined through GenBank. Based on the sequencing results, the unknown bacteria were identified as Rhodococcus sp., Bacillus sp., Paenibacillus sp., and Bacillus pumilus. The identified samples were then subjected to chemical extraction using ethyl acetate as the organic solvent. The chemically extracts were then tested against the previously mentioned ESKAPE-safe bacterial strains to determine if the antimicrobial compound(s) were successfully extracted. The samples identified were shown to produce antimicrobial activity against Escherichia coli, Staphlococcus epidermis, and Enterobacter aerogenes.

P113 The immunoproteasome may not be responsible for increased MHCI presentation in the presence of TNF-a

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Our lab hypothesized that in the instance of a viral or intracellular infection, the cytokine TNF-a utilizes the JAK2 receptor to activate immunoproteasome expression, and thus increase antigen presentation on the cell surface via MHCI. Previous studies within our lab indicated that in the presence of TNF-a, immunoproteasome levels did not decrease in a statistically significant manner when JAK2 was blocked in the presence of AG490, a chemical inhibitor of JAK2. Following those data, we hypothesized that MHCI levels would also not change in statistically significant manner when JAK2 was inhibited in the presence of TNF-a. We studied MHCI expression after inhibition of JAK2 via AG490 and treatment with TNF-a in both JAWSII (murine Dendritic cells), and C8B4 (murine macrophage) cell lines, utilizing flow cytometry to determine quantitative results for MHCI presence on the cell surface. JAWSII data showed a surprising, statistically significant decrease in the levels of MHCI when JAK2 was inhibited via AG490. When we repeated these experiments in the C8B4 cells, we observed a potential change in MHCI presentation on the cell surface when JAK2 is inhibited via AG490. These data show that JAK2 is involved in antigen presentation in JAWSII, and possibly in C8B4

cells, in a pathway that does not include the immunoproteasome. This information will allow us to better understand the pathway responsible for MHCI presentation and immune activation in the presence of an intracellular infection, and can potentially be used to develop better drug targets in the future.

P114 MultiWalled Carbon Nanotube Effects on Soil Microbes and Plant Growth

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Carbon nanotubes are used extensively in environmental and engineering applications. There are no strict rules regulating nanotube production, usage and disposal. It is therefore important to determine nanotube effects on plants and associated microbes' growth in the environment. In this study we investigated the effect of MWCNTs on *Phaseolus vulgaris* and soil microbes. Some studies have indicated that carbon nanotubes may regulate plant growth and stimulate microbial growth. Our hypothesis is that high levels of MWCNT will inhibit the growth of plants and microbes, based on this we developed the following study objectives: i. Determine the effects of the commercial multi-walled carbon nanotubes on soil microorganisms involved in Nitrogen cycling (*Mesorhizobium sp., *Nitrosomonas stercoris*). ii. Determine the effects of the MWCNT on the compressive growth parameters of bean plants under various hydroponic conditions. Phaseolus vulgaris were grown under hydroponic conditions. After germination, the plants were exposed to different concentrations of dispersed MWCNT. Cultures of Mesorhizobium sp., and Nitrosomonas stercoris were also exposed to the same concentrations. The effects of the treatment were observed by incubating the samples in a BioScreen reader for 24 hours. Our preliminary results show that that at 50µg/mL, bean plants were able to tolerate the presence of the multi-walled carbon nanotubes however exposure to 250µg/mL of MWCNTs and above resulted in very poor growth and even plant death. There was growth inhibition of the microbes used in the study, maximum inhibition was observed at 1000µg/mL MWCNT. Our results suggest that concentrations of MWCNTs at 250µg/mL and above adversely affect plant growth as well as lowered the microbial biomass. This study may serve as guideline in regulating the release of MWCNTs into the environment.

P115 Antibiotic Resistance of Vibrio Vulnificus on the Alabama-Florida State Line

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Vibrio vulnificus are flesh eating bacteria found in salt water. The flesh eating bacteria were initially discovered in Florence, Italy in 1854. The physician Filippo Pacini discovered the first species of Vibrio when a cholera outbreak occurred. He however did not discover vulnificus; instead, he discovered cholera. Vibrio's shape is slightly bent similar to a comma. V. vulnificus is found when people consume raw oysters that can lead up to a 56.4% fatality rate. Most causes were believed to happen in the warm summer months. Florida's incidence rate is double the national rate for vibrios. Individuals with wound infection related symptoms were approximately 50.7% of the 276 cases of V. vulnificus from 1998 to 2007. The V. vulnificus were found in the Gulf Coast area in Florida and Alabama. In this study samples were collected at to 2 different sample sites, Pensacola beach area of Florida and Perdido Key. The 37 total isolated vibrios were tested for the resistance to antibiotics. The purpose of this study is to test natural antibiotic resistance in Vibrio vulnificus.

P116 Yeasts isolated from environmental samples collected in Middle and West Tennessee

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The goal of this research was to collect, culture, isolate, and identify naturally-occurring, wild yeast strains. Today, members of genera *Saccharomyces* and *Brettanomyces* are both used in commercial brewing and are the genera of interest to this study. Yeast strains were isolated from plant matter collected in the deciduous forests of Middle Tennessee and West Tennessee, as members of the target genera are known to have the capability to survive on plants. These samples yielded 15 isolates: 7 from Middle Tennessee and 8 from West Tennessee. The ITS (Internal Transcribed Spacer) region (rRNA) of each sample was amplified using PCR and sequenced. These samples were identified to the levels of genus, species, and strain using data available in GenBank. Herein, we present the results of the microbiological and molecular studies of these yeast samples.

P117 Analysis of local mosquito populations for the *Wolbachia* endosymbiont

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Wolbachia is a bacterial endosymbiont that resides in the reproductive cells of insects and other arthropods. The affect of this infection in insects is to increase the number of infected females through four reproductive manipulations: cytoplasmic incompatibility, parthenogenesis, feminization, and male killing. We are currently screening 14 local mosquito species for *Wolbachia* infection. Several local mosquito species are vectors for the arboviruses West Nile, Zika, Dengue, Eastern Equine Encephalitis, and Chikungunya. Mosquitoes were collected in Chatham County by the local Mosquito Control agency and identified to species. We were given ten individuals each from 14 different species for analysis. Using primers specific for *Wolbachia* sequences, we determined which collected individuals were positive for the *Wolbachia* parasite. The resulting information could be used in efforts to control local mosquito populations and in efforts to limit the spread of arborviuses.

P118 Ant Biodiversity in Switchgrass Fields and Other Land Cover Types in the U.S.

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In response to climate change, many nations such as the United States have begun to shift away from traditional fuels, primarily fossil fuels, and toward cleaner forms of energy, such as energy derived from biofuels. Switchgrass, *Panicum virgatum*, is one popular bioenergy crop, and the effects of its widespread landscape incorporation on biodiversity and ecosystem processes have been favorably viewed relative to alternatives. The effects of switchgrass monocultures on certain arthropod communities, specifically ants, are unknown. A loss in ant biodiversity could have an effect on certain ecosystem services, such as bioturbation. In this study, ant diversity is compared between monoculture fields of switchgrass and non-switchgrass land cover types that could potentially be converted to switchgrass monocultures in Pennsylvania, Tennessee, and Kansas. Insect specimens were collected using pan traps in the summers of 2014 and 2015, and all ant specimens

were separated for further identification. Ants were identified to the species, and ant abundance and diversity among the Switchgrass monocultures and the native fields were compared using community analysis metrics. Preliminary analysis of subsets of data indicates a difference in community composition between the monoculture and natural fields. Furthermore, continued conversion of other land cover types to switchgrass monoculture could result in changes in ant biodiversity and abundance.

P119 Elemental defense of seeds by a nickel hyperaccumulator against a generalist seed herbivore.

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Hyperaccumulation has been proposed as an elemental defense against herbivores. This study included three annual *Streptanthus* species from California serpentine soils: one nickel hyperaccumulator (*S. polygaloides*) and two non-hyperaccumulators (*S. albidus* and *S. insignus*). We tested whether nickel in seeds of *S. polygaloides* may be an elemental defense against seed herbivores. Seeds of the three species were fed to the representative generalist seed herbivore *Tribolium confusum* (Coleoptera: Tenebrionidae). Beetles were fed either whole or cut seeds of each of the species: this additional experimental factor allowed beetles easier access to the embryo. Beetles were randomly assigned treatments and survival was recorded over a seven week period and both beetles and seeds were tested for nickel concentration using ICP-OES. Survival analysis showed significantly greater mortality for beetles consuming seeds of *S. polygaloides* compared to those consuming non-hyperaccumulator seeds. Beetles fed whole hyperaccumulator seeds had a greater and faster rate of mortality than those fed cut hyperaccumulator seeds. Whole seeds of *S. polygaloides* had approximately 300 µg/g Ni while the non-hyperaccumulator seeds had approximately 5 µg/g Ni. Beetles fed whole hyperaccumulator seeds contained more than 2.5-fold greater Ni concentrations than those fed cut seeds (approximately 60 and 25 µg/g Ni, respectively). Beetles fed either cut or whole non-hyperaccumulator seeds contained less than 0.3 µg/g Ni. An artificial diet study, using nickel-amended cornmeal, confirmed that diet nickel concentrations greater than 240 µg/g Ni were toxic to *T. confusum*. We conclude that nickel in *S. polygaloides* seeds can act as an elemental defense against seed herbivores even at levels less than the 1000 µg/g nickel hyperaccumulation threshold concentration.

P120 Current status of *Cylindera cursitans* (LeConte) (Coleoptera: Carabidae) in Alabama

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Stephen Krotzer

The ant-like tiger beetle, *Cylindera cursitans* (LeConte), is a small tiger beetle previously represented in western Alabama from only a few records. Recent collections in the state suggest it is much more abundant than once thought. Presented is an updated distribution of C. cursitans for the state with a brief discussion of habitat and historical records.

P121 A new state record for *Gonatista grisea* (Fabricius) (Mantodea: Liturgusidea) and a brief review of its distribution in the United States

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The grizzled mantid, *Gonatista grisea* (Fabricius), is a cryptically colored species of Cuba and the southeastern United States where it is distributed through Florida and the Coastal Plain of Georgia and South Carolina (Gurney 1950). A new state record for Alabama is presented with a brief discussion of its distribution within the United States.

P122 Variation in Areola Size in Introduced Populations of *Orconectes virilis* in Southern Canada and Northern United States

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Invasive species pose challenges for freshwater communities, from vectoring diseases to damaging waterways and out-competing native species. Morphological plasticity may allow some species to be more successful at invading and establishing populations in novel habitats. Areola size in crayfish has been hypothesized to affect dissolved oxygen uptake in crayfish species. A narrower areola provides more space for gill attachment, increasing the gill volume of the animal. If morphologically plastic, individuals living in lower dissolved oxygen environments, such as lakes, may exhibit a higher gill volume compared to stream-dwelling conspecifics. This increased gill volume could allow crayfish living in lower dissolved oxygen environments to absorb the oxygen they need more easily than individuals with wider areola. To test whether crayfish from lake habitats have narrower areola than crayfish taken from river habitats, 719 introduced *Orconectes virilis* individuals from southern Canada and northern United States was examined. Measurements were taken of the length and width of the areola and carapace length, to control for the size of the individual. Individuals were grouped as "lake" or "river" depending on the location they were collected from. Lakes were meant to represent a relatively lower oxygen environment compared to rivers, which represented a higher oxygen environment. We found that individuals did differ in areola size based upon the environment where they were collected ($p = <0.001$, $r2=0.049$). Lake dwelling crayfish tended to have narrower areola (average= 0.15 cm), while river dwellers had wider areola (average=0.18 cm). This suggests that lake dwelling crayfish are attempting to maximize gill volume, compared to stream dwelling individuals. Future work will focus on the respiratory capacity of *O. virilis* individuals with variations in areola width, to determine if the changes in gill volume have an impact on an individual's ability to absorb oxygen from the water.

P123 Effects of the Neonicotinoid Imidacloprid on the Electroretinogram (ERG) of Hymenopteran Insects

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Neonicotinoids are systemic insecticides which are typically applied to the seeds of crop plants, become distributed through the plant tissues, and are neurotoxic to insect pests by acting as potent nicotinic receptor antagonists. The widespread use of neonicotinoids has been implicated in the increasing incidence of Colony Collapse Disorder (CCD) in honeybees, presumably due to exposure during pollination. Behavioral studies have found that acute exposure to the neonicotinoid imidacloprid can interfere with the ability of worker bees to successfully forage and return to the hive. A possible mechanism for this is suggested by a study of the electroretinogram (ERG) response of the peripheral visual system in the fruit fly *Drosophila melanogaster* which found that acute imidacloprid application to the surface of the eye interferes with retinal reset and slows the rate at which photoreceptors in the eye return to the resting state after a light flash stimulus.

We have recently developed methods for recording electroretinogram (ERG) responses to simple light flashes from two hymenopteran species, the European honeybee *Apis mellifera* and the parasitoid jewel wasp *Nasonia vitripennis*. In both species a single acute application of imidacloprid to the surface of the eye at concentrations of 100uM - 2mM extends the recovery phase of the slow retinal component of the ERG over a time span of 5-60 minutes. These results match the reported results from *Drosophila* and suggest that environmental neonicotinoid exposure may compromise the visual systems of hymenopteran insects. This could partially account for the putative role of neonicotinoids in honeybee CCD and further implicate neonicotinoids as a potential threat to parasitoid insect control species.

P124 Revision of Gymnoscirtetes (Orthoptera: Acrididae): A grasshopper genus endemic to the Southeastern United States

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The genus Gymnoscirtetes (Orthoptera: Acrididae) is endemic to the Coastal Plain of the southeastern United States where it is restricted to Florida, central and southern Georgia, and extreme southeastern Alabama. Over most of the range, these tiny, slender grasshoppers are inhabitants of grasslands such as low, moist portions of flatwoods, particularly when such areas slope down to and border a bayhead, bog, hydric hammock, swamp, or pond, though, occasionally they can be found in sandhills. Two species (Gymnoscirtetes pusillus Scudder and Gymnoscirtetes moresi Hebard) are currently assigned to this genus. Owing to their small size, lack of wings, the inability to fly, environmental restrictions, and the discontinuous distribution of their habitat, the genus breaks into a host of more or less isolated demes. Given the growing interest in the biodiversity of the North American Coastal Plain and the recent classification of the region as a biodiversity hotspot, a revision of this genus was undertaken. Based on the morphological features of the males, Gymnoscirtetes can be divided into six allopatric species and two distinct species groups. The allopatric distributions of many of the species of Gymnoscirtetes can be adequately explained on the basis of natural barriers such as major rivers of the region, thus it is hypothesized that this genus diverged during and after the Pleistocene as a result of widening rivers and bottomland forests that would have isolated populations of these grassland inhabiting insects.

P125 The Influence of Epigenetics in Caste Polyphenism in Female Honeybees (*Apis mellifera*)

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Polyphenism, the existence of alternative phenotypes resulting from environmental cues rather than genetic differences, is exhibited in the female castes of honeybees: queens and workers. The distinctive features in colony females are controlled by nutritional stimuli; that is, larvae fed on copious amounts of royal jelly mature into queens, which develop faster, are larger in size, have larger ovaries, and live longer than workers. Recent studies have provided further details of bee polyphenism resulting from epigenetic regulation, and this presentation will examine some of the epigenetic activities that have been identified. The complex process by which a gene produces a protein is called gene expression and involves two stages-transcription (DNA to mRNA) and translation (mRNA to protein). In general, epigenetics refers to any mechanism that influences gene expression without changing the nucleotide sequence of the DNA of a gene. Epigenetic regulation directs when, how, and to what degree genes are turned on, and these controls operate in response to shifting chemical conditions. As in humans, stable epigenetic

processes have been shown in some insect species to be critical for normal development. In *Apis mellifera*, certain epigenetic mechanisms have been found to be important in maintaining female caste differentiation. Royal jelly has been shown to suppress the expression of an enzyme that chemically attaches methyl groups to genes, and this reduction in methylation sets in motion a series of processes that lead to the development of a queen. In addition, it has been proposed that DNA methylation works in concert with other epigenetic mechanisms, including post-transcriptional alteration of mRNA, to influence queen and worker development.

P126 The Effects of Arginine Vasotocin and Female Body Condition on Maternal Care Behavior in a Viviparous Snake, *Sistrurus miliarius*

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Maternal care behaviors are exhibited in several different species of snakes and are expressed through neonate attendance and offspring defense. However, we know very little about the mechanisms that modulate the level of maternal investment in offspring after birth. Previous research indicates that mothers with greater energy stores aggregate more closely with offspring and that blockade of arginine vasotocin (AVT) receptors in Pigmy Rattlesnakes significantly disrupted maternal attendance behaviors. To experimentally test the hypotheses that care is modulated by maternal energetic status and that hypothalamic peptides mediate maternal care behaviors in viviparous snakes, we supplementally fed pregnant pigmy rattlesnakes and injected postpartum females with AVT to determine if it would enhance maternal attendance compared to saline-injected control snakes. In the summers of 2015 and 2016 we field collected 32 pregnant *S. miliarius*. The snakes were held in outdoor enclosures and monitored daily until parturition. They were then randomly assigned to a supplemental feeding regime and a hormone treatment group, placed in large outdoor cages and photographed with their offspring three times each day. Measures of spatial aggregation for each mother-offspring group were calculated from these photographs. Our results indicate that the intensity of the maternal care behaviors (estimated by the spatial relationships between mother and neonate) were strongly influenced by maternal post-parturient energetic status. Females with higher body condition indices were significantly more attentive to their neonates. The AVT injection, however, had no significant effect on the intensity of maternal attendance. These results highlight the importance of female energetic status on the quality of parental care as has been seen in other vertebrates. Further research should be conducted to better understand the involvement of peptide hormones on the expression of maternal behaviors.

P127 Phylogeographic structure and speciation in a tiny vertebrate species: Seepage salamanders (*Desmognathus aeneus*)

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Desmognathus aeneus is one of the smallest vertebrates with concomitant home ranges (<1 m2). They are distributed from the Appalachian mountains of extreme western North Carolina southwestward into Alabama. Across this distribution populations are often disjunct and isolated in pockets of ideal habitat. Taken together, these life history characteristics suggest that seepage salamanders populations should be demonstrate strong phylogeographic structuring. We sampled ~50 populations from across the entire range extent and sequenced two mitochondrial genes, ND2 and COX1 (~2,000 bp), and three independent nuclear

loci (~3000 bp) for each population. We aligned the sequence data and then estimated models of nucleotide substitution for both individual gene and concatenated datasets. We estimated phylogenies with both Bayesian and likelihood optimality criteria and tested for the presence of multiple species within seepage salamanders.

P128 The Effect of Conspecific Presence During Feeding Events on Free Cortisol Levels and Feeding Performance in Juvenile *Alligator mississippiensis*

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For juvenile *Alligator mississippiensis* agonistic behaviors function to mitigate situations of conflict among conspecifics and have been linked with elevations in stress hormone levels. To assess this we utilized two experiments investigating the feeding performance and water-borne cortisol concentrations of captive-reared juvenile alligators during feeding events in the presence of a conspecific. Measuring water-borne cortisol levels allow the response observed for an individual to be attributed to experimental manipulation rather than handling stress. We tested the hypothesis there would be a significant difference in feeding kinematic variables and in cortisol concentrations between individuals fed in the presence of a conspecific compared with feeding individually. Water samples were collected during each treatment and cortisol was measured using an immunoassay kit. Consecutively, individuals were filmed feeding independently or with a conspecific and feeding kinematics were summarized by analyzing maximum gape, attack velocity and attack duration. Results of a series of paired t-tests indicated cortisol concentrations and feeding kinematics were not significantly different between individuals feeding independently or with a conspecific. Similarity of cortisol levels and feeding performance between treatments may be explained by the juvenile social behavior of forming crÃ¨ches, and may afford individuals the opportunity for cooperation in acquiring food resources.

P129 A comparison of habitat use among six species of aquatic snakes occurring in the Reelfoot Lake area of northwest Tennessee

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Although several studies have addressed microhabitat use by aquatic snakes in the genus *Nerodia*, few have focused on larger-scale habitat use in areas where several species co-occur. We compared the distribution across six main habitat types for five species of snakes in the genus *Nerotic* and one in the genus *Agkistrodon*. The study was conducted from late March through early August 2016 in the Reelfoot Lake area in Lake and Obion counties in northwest Tennessee. We conducted visual surveys for snakes in habitats that we categorized as one of the following: lakeshore; ditch/slough; stream; temporarily folded wetland; forested lacustrine; or emergent lacustrine. For each individual that was observed, habitat type was recorded and the percent canopy cover, distance to permanent water, and distance to open water were measured. A total of 116 snakes was observed during the study and Chi-square analysis indicated that in three of the species, habitat use was significantly different from random. *Nerodia rhombifer* (Diamond-backed Watersnake) was observed much more frequently in lakeshore habitats than was expected and *N*. *erythrogaster* (Plain-bellied Watersnake) was observed more frequently in temporarily flooded wetlands. *Nerodia fasciata* (Broad-banded Watersnake) was distributed more evenly across the different habitat types.

Analysis of variance indicated a significant difference among species in the distance to permanent water with *N*. *erythrogaster* exhibiting the highest value for that variable. Pianka's Index of Niche Overlap showed that *N*. *erythrogaster* and *N*. *fasciata* were most similar in their habitat use, and *N*. *rhombifer* and *N*. *erythrogaster* were the least similar.

P130 The effect of prey elevation on caudal luring in neonate pigmy rattlesnakes (*Sistrurus miliarius*)

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Caudal luring is a form of aggressive mimicry utilized by ambush predators including *S. miliarius* which allows the predator to remain inconspicuous while enticing prey to come within striking distance. The motions involved in caudal luring vary both among and within snake species, with no clear explanations for this variation. We examined whether the caudal luring behavior of pigmy rattlesnakes was dependent upon the perch elevation of green tree frogs (*Hyla cinerea*), a common prey item. We captured 21 pregnant females and held them in field enclosures until parturition. Foraging encounters were simulated by placing 55 neonates into experimental arenas after their first shed, giving them 24-48 hours to acclimate, and then presenting them with a frog tethered at either a high (20 cm) or low (0 cm) elevation perch above the substrate. Each snake was exposed to both elevation treatments in random order. We recorded their foraging behavior for approximately 15 minutes and analyzed the videos for caudal luring, luring latency (the time period from prey introduction to the start of luring, and luring amplitude (the area over which the tail was moved). Thirty-seven percent of all snakes lured but the proportion of snakes luring was not significantly related to prey elevation. We found no significant effect of prey elevation on luring latency or luring amplitude. Our results indicate that variation in luring behavior is not dependent on prey elevation, but as indicated by other studies, may be more strongly influenced by other factors such as prey type.

P131 The Growth and Movement of *Gopherus polyphemus*

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Gopherus polyphemus is a fossorial keystone species that inhabits sandy less dense areas of the southeastern United States. Its distinctive burrows are often home to more than 300 species, including several that are endangered. This makes their success crucial to continued diversity of their habitat. Because of their fossorial and cryptic nature not much is known about their growth and movement over a long period. In the summer of 2016 11 female, 15 male, and 2 juvenile gopher tortoises were captured in George L. Smith State park in the continuation of a 23 study. The captured tortoise's straight carapace length (SCL), straight carapace width (SCW), depth, straight plastron minimum (SPmin), and straight plastron maximum (SPmax) were measured and compared with measurements taken in previous years. Females showed an average growth rate of 0.1004 cm/year in SCL, 0.0803 cm/year in SCW, 0.0455 cm/year in depth, 0.0464 cm/year in SPL minimum, and 0.0676 cm/year in SPL maximum. Males showed an average growth rate of 0.1643 cm/year in SCL, 0.1207 cm/year in SCW, 0.0743 cm/year in depth, 0.1079 cm/year in SPL minimum, and 0.1398 cm/year in SPL maximum. Female tortoises were then taken off site to be x-rayed for eggs. The average clutch size for 2016 was 6 although the number of gravid females were down significantly. Afterward GPS coordinates were recorded and compared with data from 2014 and 2015. The gopher tortoises on average showed little movement within the environment.

P132 Visible Implant Elastomer (VIE) study in *Anolis carolinensis*, as a viable mark-recapture technique

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Marking techniques for wildlife must meet the following criteria - marks should: 1) not affect the behavior or survival of individuals; 2) not cause undue pain or stress; 3) last as long as the study; and 4) be easily identifiable. Visible Implant Elastomer (VIE) is a standard marking technique used for many amphibian and reptile mark-recapture population studies. However, few studies have assessed the long-term retention of VIE as a marking technique. We examined the effectiveness of VIE as a marking technique and its effect on body condition (growth and health) for the Green Anole, Anolis carolinensis, in a laboratory setting for 3 months. We determined the readability of marks over time and evaluated quality of health after VIE injections were given. Our study includes a total of 34 anole lizards (10 marked with Blue VIE, 12 marked with Yellow VIE, and 12 sham controls) on the dorsal rear left and right limbs. We found that there has been ~100% tags retained and consistent readability after 3 months confirmed via photo documentation. In addition, we noted no major differences in overall body condition or health of marked individual lizards. We conclude that VIE is an effective and safe marking technique for long-term mark- recapture studies.

P133 A New Species of "Desmognathus" identified within Northern Dusky species complex

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"Desmognathus fuscus" commonly known as the Northern Dusky is a medium sized lungless salamander with a geographic range from Quebec to South Carolina. Long recognized as a single species, recent publications have suggested that "D. fuscus" represents a species complex and deserves more intensive investigation. Research in our lab has revealed an apparently new species of "D. fuscus" found in the headwaters of the Pee Dee river drainage system. We have extensive sampled throughout the Blue Ridge escarpment in the vicinity of the known localities of the "new species" . In total we sampled over 70 populations and for each population we sequenced a ~600 bp fragment of mitochondrial gene (Cox1) and for a subset of the populations we collected sequence data for 400 genes using the anchored hybrid enrichment protocol. We analyzed our sequence datasets using Bayesian phylogenetic reconstruction and tested for signatures of speciation for the headwater Pee Dee dusky salamander populations. Our data strongly support that populations of northern dusky salamanders from the headwaters of the Pee Dee river drainage system are a new, currently undescribed species of "Desmognathus".

P134 Effects of Human Disruption of Previous Contact Between Two Parapatric Salamander Species, *Eurycea cirrigera* and *Eurycea wilderae*

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Studying contact zones is important to understanding the process of speciation. When a contact zone exists between two closely related species, differences may be exaggerated as a result of character displacement, or introgression may occur, homogenizing genetic and morphological differences. An under-studied aspect of contact zones is the potential influence of anthropogenic changes to the landscape

on the nature of contact and thus the nature of interspecific interaction. *Eurycea cirrigera* and *E. wilderae* are cryptic members of the *E. bislineata* species complex that share a parapatric boundary along the foothills of the southern Appalachian Mountains. The two species occur sympatrically along the narrow zone of contact, and population interactions range from reproductive isolation to introgressive hybridization. The two species occur sympatrically within the Hazel Creek watershed in Habersham County, Georgia, where morphological intermediacy suggests current or past hybridization. Piedmont College's athletic-field complex, which was built in 1960, separates the two species completely in one stream within this watershed. The purpose of this study was to investigate the effect of this athropogenic separation on any signature of past hybridization between *E. cirrigera* and *E. wilderae* by analyzing both mitochondrial and nuclear markers. The data showed no evidence of hybridization at Piedmont College, although clear evidence of hybridization was uncovered at a nearby (less than 3 km) site where the species are syntopic. The rapid (< 60 years) eradication of any signature of hybridization at the College site implies strong selective pressures against hybrid offspring. This confirms that human-induced changes to local landscapes can impact species contact zones and perhaps the speciation process itself.

P135 Impacts of Alligator Weed (Alternanthera philoxeroides) on Southern Toad (Bufos terrestris) Development and Algal Growth in Aquatic Systems

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Alligator Weed is an invasive plant species that originated in South America that was introduced to the United States in 1897 through the shipping industry by ballast water. The success of this plant is not only due to the allelopathic chemicals it produces but also because of its asexual reproductive properties. Alligator Weed is known to blanket the surface of the water leaving limited resources for native plants. The chemicals Alligator Weed produces are known to inhibit or alter algal communities, which are the primary food source for other organisms within aquatic systems. Alligator Weed exposure experiments were conducted within the lab and were compared to the effects of a native plant, Sagittaria latifolia, which is not known to produce allelopathic compounds harmful to amphibians such as the Southern Toad. Concentration of algal growth was measured using a spectrophotometer in order to quantify the trophic level effects of Alligator Weed on algal communities and amphibians. Alligator Weed adversely affected both algal concentration and tadpole development.

P136 Genetic Exchange between Two Species of Two-lined Salamander (*Eurycea bislineata* Species Complex) at their Parapatric Boundary in Northeastern Georgia

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The nature of contact that occurs between two recently diverged species represents a significant aspect of both population and evolutionary biology. As divergence progresses and reproductively isolating mechanisms become established, such contact can result in various interspecific interactions that may or may not involve gene exchange between populations. Hybridization is one such result of secondary contact and can range from panmixis to gender- or species-related bias during mating events. We examined a contact zone between two cryptic, parapatically distributed members of the *Eurycea bislineata* species complex, *E. wilderae* and *E. cirrigera*, to investigate the nature of potential hybridization in northeastern Georgia. DNA was extracted and sequenced from approximately twenty individuals

of each species at each of three locations in which both species have been observed. At least one of these sites contains individuals with intermediate phenotypes. Examination of the mitochondrial gene ND2 and nuclear marker POMC confirmed introgression at one location. The nuclear intron exhibited considerable haplotype sharing between the species. This may be the result of too little time since species generation for nuclear lineages to have fully assorted. The contact zone between these species appears to consist of a mosaic of interspecific interactions ranging from reproductive isolation to introgressive hybridization.

P137 Investigation of the identity, bioaccumulate in aquatic biota, and toxicity bioassay of polychlorinated biphenyl (PCB) congeners in the Coosa River and its Rome tributaries in Floyd County, GA.

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Since 2003, there have been excavations to remediate PCB-contaminated soils from property associated with Rome, Georgia's General Electric plant. PCBs [polychlorinated biphenyls] are known carcinogens, and are a persistant pollutant documented to bioaccumulate in fatty tissues of living organisms. Two streams and adjacent lands have received remediation activities to remove and dispose of contaminated soils that drain into these waterways; Horseleg Creek and Little Dry Run Creek. This undergraduate research study investigates the presence of residual PCBs in aquatic habitats. In the preliminary phase of this investigation, environmental samples are processed using soxhlet extaction, thin layer chromatography and GC/MS analysis respectively to isolate, separate and detect the presence of PCB congeners; dichlorobiphenyls or trichlorobiphenyls, for example. Comparison of Rapid Assessment assays published in the literature will be compared to GC analytical findings from this study. Additionally, from the base of the food web to aquatic vertebrates like fish and amphibians, researchers will assay biota for bioaccumulation. Primary congeners identified in the local aquatic ecosystem will be used to evaluate environmental toxicity (LC50) in bioassay analyses using Daphnia magna in aquatic cultures. We anticipate certain free parent PCB compounds and congeners that result from environmental degradation and biological oxidation will be shown to be more toxic [greater LC50] than degraded congeners isolated in the food web. This project is funded by a TriBeta National Biological Honor Society Undergraduate Research grant.

P138 The relationship between black spot disease (BSD) intensity and food intake in *Gambusia affinis*

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Parasite-induced changes in the physiology and behavior of a host organism is a fascinating but poorly understood phenomenon. Parasites may influence foraging behavior in the host by increasing their metabolic demands, although host response (e.g., increased versus decreased foraging behavior) depends on both the identity of the parasite and the host, among other factors. Overall, species-specific research regarding the influence of parasites on nutritional intake and/or foraging behavior is needed in order to understand more deeply the varying mechanisms that parasites use to modulate behaviors in their hosts. Black spot disease (BSD) is a prevalent parasitic infection in fish caused by a digenetic trematode that is understudied in the context of foraging behavioral modification. We collected approximately 100 Western Mosquitofish (*Gambusia affinis*) from Valley Creek in Birmingham, Alabama to determine whether foraging activity (based on mass of the gut) was

related to intensity of BSD infection. We predicted that gut mass would increase with intensity of BSD infection. Gut mass increased with BSD intensity when we controlled for body length, indicating that BSD likely increases the feeding behaviors and thus food intake of *G. affinis*. However, our findings indicate that this relationship is modulated by both body length and sex, such that intensity of BSD infection had a more positive relationship with gut mass in small fish as opposed to medium and large fish, and that this relationship was stronger in small males than in small females. These results are consistent with the hypothesis that BSD infection imposes additional nutritional demands on *G. affinis*. Moreover, this finding implies that the greater the intensity of the BSD infection, the greater the energy expenditures it imposes on its host, particularly in small males.

P139 Age and growth of Central Stonerollers (*Campostoma oligolepis*) across a range of urbanization

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Urbanization alters fish communities in a variety of ways and the effects of urbanization vary from species to species in any given assemblage. Although most species are negatively affected, there are some tolerant species whose abundance may increase in urban streams. Past research has indicated that Largescale Stoneroller (*Campostoma oligolepis*) abundance increases in urbanizing watersheds of the Etowah River Basin in the Metropolitan Atlanta area. The current study looks at age and growth of Largescale Stoneroller across a range of watershed urbanization (assessed using landscape measures of impervious surface cover - ISC) using otoliths. Stonerollers were collected from four streams with differing levels of urban impacts (ISC ranging from ~0.6% to ~ 30.0%), euthanized using MS222, measured for total length, and the lapillus otoliths were removed. Otoliths were embedded in epoxy, sanded to expose the nucleus, and then examined under a microscope to identify annuli. Distance from the nuclei to each annulus and to the otolith margin was measured and used to back-calculate length at age. Preliminary results indicate that Central Stonerollers in streams with higher ISC grow more rapidly than those from stream with lower levels of ISC.

P140 Thermal Tolerances of the Exotic *Daphnia* *lumholtzi* and Native *Daphnia* from an Alabama Estuary

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Daphnia *lumholtzi* is a planktonic crustacean that was unintentionally introduced to Texas reservoirs and has since spread rapidly to water bodies throughout the U.S. In reservoirs, it has been shown that tolerance to high water temperatures allows the tropical *D.**lumholtzi* to exploit a vacant thermal niche during summer months when native *Daphnia* species undergo seasonal declines. However, it is less clear what characteristics have contributed to *D.**lumholtzi's* ability to rapidly colonize other aquatic ecosystems. We investigated the occurrence and thermal tolerance of *D.**lumholtzi* in the Alabama Mobile-Tensaw Delta. In our monthly field samples collected from 2012 through 2014, *D.**lumholtzi* and native Daphnia were both present throughout the year, at water temperatures ranging from 14°C to greater than 32°C. In laboratory thermal tolerance assays using *D.**lumholtzi* and native species collected from our field sites, there was no significant difference in 36-hour survival following exposure to typical summer water temperatures (32°C-35°C, p=0.659), and summer extremes (37-38°C, p= 0.687). Heat death trials

showed that there was no significant difference in the critical thermal maximum (38-39°C) between *D. lumholtzi* and natives (p= 0.116). These results suggest that in contrast to the pattern observed in reservoirs, *D. lumholtzi* is not occupying a vacant thermal niche in the estuary. Current studies are exploring this further by investigating differences in life history traits in *Daphnia lumholtzi* cultured under different thermal regimes.

P141 Estimating portable antenna capture probabilities of PIT-tagged fish in a small stream

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Miniaturization of passive integrated transponder (PIT) tags has allowed application of this marking technology to increasingly smaller organisms, including fishes as small as 50 mm total length (TL). In streams the utility of PIT tags has been further enhanced by the development of portable hand held antennas that allow detection of free-ranging fishes. In this study, we assess the probability of capture of PIT-tagged Creek Chubs (*Semotilus atromaculatus*) and Redbreast Sunfish (*Lepomis auritus*) in Kennesaw Creek, Georgia. Prior to sampling, a continuously monitoring instream stationary antenna was placed at the lower end of a 200 m sampling reach that was bounded on the upper end by an impassable culvert. Creek Chubs and Redbreast Sunfish greater than 50 mm TL were collected from the reach with a backpack electroshocker, anesthetized with buffered MS-222, injected with a uniquely coded PIT tag, placed in holding containers to allow recovery, and then returned to the stream at their point of capture. The entire reach was sampled once per week with the handheld portable antenna and detections noted. Prior to sampling with the portable antenna, detections were downloaded from the instream antenna to determine if any tagged fish had moved out of (or back in to) the study reach between sampling periods. Since we sampled a known population of tagged fish, it is possible to estimate overall capture probabilities for the two species. The results of our study can be applied to studies of open populations of similar species in other stream systems.

P142 A novel, extremophile annelid in a sulfur spring in Blount County, AL

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David Johnson

We have discovered a novel oligochaete in the sulfur-rich waters of several spring heads at Blount Springs, Blount County, AL. 18S rDNA and COI sequencing reveal it to be a member of the genus *Limnodrilus*, but apparently a different species from *Limnodrilus sulphurensis*, discovered in a sulfur cave in Colorado. We report on preliminary morphological and taxonomic characteristics of this new worm.

P143 Identifying *Daphnia* Species by Morphological Traits and DNA Barcoding

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The zooplankton *Daphnia lumholtzi* is a non-indigenous species (NIS) of tropical and subtropical origin that has spread rapidly throughout US waterways. To understand this rapid range expansion, it's important to not only monitor *D. lumholtzi* distribution, but also occurrence relative to native species. Identifying invertebrate species present in field samples is typically done by comparing

morphological traits of individual specimens to anatomical keys. Because *Daphnia* species identification can be complicated by high phenotypic plasticity, we have been testing the use of DNA barcoding with zooplankton-specific primers to confirm morphological identifications. In this study, we sought to use morphological and genetic analysis to 1) test the suitability of DNA barcoding for identifying species in field samples stored in ethanol and 2) identify the primary species present in field sites where *D. lumholtzi* and native species occur together. Morphological analysis identified *Daphnia lumholtzi*, *Daphnia ambigua* and *Daphnia obtusa* in ethanol-stored field samples taken from the estuary throughout the year. A fourth species present in these samples appeared to be either *D. laevis* or *D. dubia*, but its identity could not be distinguished conclusively based on anatomical features. DNA barcoding was successful in samples stored in 95% ethanol for up to two years, and confirmed our morphological identifications. However, the *D. laevis* sample was identified genetically as *D. magniceps*. While these species are closely related, to our knowledge, neither has been previously reported in Alabama estuaries. Other genetic markers will be required to confirm whether both are present in our study site. DNA barcoding is ongoing to confirm technique validity, and native species identity in field samples. These studies will allow us to better understand the community structure in the estuary where the invasive *D. lumholtzi* and native species occur together.

P144 Molecular analysis of the prokaryotic flora of sulfur springs in Blount County, AL

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Daniel Huang, Langley Dillenberger, Logan Thomas, David Frings, David Johnson

We undertook environmental sampling of the prokaryotic flora of water samples from Blount Springs, Blount County, AL. 16S rDNA PCR-amplification, TOPO-TA cloning, and Sanger sequencing revealed a number of sulfur-metabolizing bacteria and archaea. We plan to carry out 16S rDNA next-generation sequencing of samples to draw a more complete picture of the sulfur-spring flora and their possible roles in geological activity.

P145 Characterization of an Unusual Population of *Isoetes* (Lycopodiaphyta), a Potential New Species

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A large and unusual population of *Isoetes* within the DeSoto National Forest along Hall Branch in Wayne County, Mississippi, was studied in order to determine if it is a new species of quillwort or a variation of the one primary species of the longleaf pine belt, *I. louisianensis*. *Isoetes louisianensis* is an endangered species of quillwort found in Louisiana and Mississippi. The Hall Branch population and specimens of known *I. louisianensis* were examined comparatively based on morphology, leaf anatomy, megaspore characterization, examination of habitat characteristics, chromosome counts, and analysis of DNA sequences. In addition, the study contributes to enhanced scientific understanding of* I. louisianensis*, as much about this species is still unknown because *Isoetes* species are similar in appearance, readily crossfertilize to form sterile hybrids, and exhibit polyploidy. Morphological characterization of the megaspores has been used traditionally to identify different species of *Isoetes*, but the megaspores of separate species are often similar in appearance and are therefore challenging to differentiate without scanning electron microscopy. Plants of the genus *Isoetes* also vary widely depending on environmental factors, and a single species can exhibit a range of

morphologies depending on external factors. Preliminary data indicate that there is variation between the Hall Branch population and populations of known *I. louisianensis*.

P146 The eukaryotic micro- and macrobiota of a sulfur spring in Blount County, AL
Mariel McConville, Samford University, Department of Biological and Environmental Sciences, Birmingham, AL, 35229
David Johnson

We undertook environmental sampling of the eukaryotic biota of water samples from Blount Springs, Blount County, AL. 18S rDNA or COI PCR-amplification, TOPO-TA cloning, and Sanger sequencing revealed a number of unicellular and metazoan organisms in an isolated stream segment flowing from one spring head. We plan to carry out further analysis (including next-generation sequencing) to draw a more complete picture of this sulfur-spring eukaryotic community in comparison to that of the main nearby freshwater stream into which the sulfur-rich water flows.

P147 Fecundity and Mortality in *Bellamya japonica*, An Invasive Freshwater Snail
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Jacob Bartell, Joanna Bauer, Jeffrey Brady, Cody Davis, Edwina Mathis, Taliyah Smith, Harold Taylor, John Hains

The Japanese mystery snail, *Bellamya japonica* (von Martens 1861), is an invasive species to Lake Hartwell, and the only reported occurrence in the Savannah River Basin. There are other infestations throughout the Southeast, notably in Lake Greenwood, SC as well as other parts of the United States. We have studied fecundity rates through weekly observations to determine seasonal effects on fecundity. Recently we completed the first continuous year of such observations. Fecundity is the fertility of a species and its ability to produce viable offspring. Fecundity plays an important role when studying an invasive species because it is a huge factor in determining ability to invade. Before this study, there was little on fecundity rates and other ecological characteristics of *B. japonica*. Our experiment employs 25 chambers each containing a single female snail of reproductive size. Weekly observations determined the number of offspring produced per female. We detected a seasonal temperature effect on the fecundity, an expected result. Fecundity was greatest in the warmer months and usually minimal during the colder months. This past year was the first year that data was collected during the summer months and that data was consistent with the continued high fecundity during the warmer months. A secondary aspect of population dynamics was also explored: the study of mortality rates, especially of snails with damaged or eroded shells. The damaged shells were sealed using sealant and placed in tanks to measure their survival. Past attempts at this study yielded equivocal results and questions remain regarding possible toxic effects of the chemicals in the sealant used to 'repair' eroded shells. We are revising this experiment with specific improvements to multiple aspects of the experimental design. Coupled with the fecundity results we may better understand the population dynamics of this important invasive species.

P148 Plankton Entrainment by Water Intakes: A Case Study and Limnological Influences
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John Hains

During the spring and summer of 2016 we studied the entrained organisms at the Clemson University water intake facility, located on Lake Hartwell, SC. The purpose

was to monitor for potential ichthyoplankton entrainment but it gave us an opportunity to study other entrained organisms as well. The study began in May and ended in September with samples being taken approximately every two weeks. We sampled the flow by tapping into the raw water supply with a 5 cm (2 inches) tap and valve. The flow rate was measured empirically and two samples were collected using a plankton net (333 um mesh). Sample volumes of 5 m3 and 10 m3 were collected and preserved with alcohol and then enumerated microscopically. In addition, dissolved oxygen and temperature conditions were measured both in the sample flow and in the lake. Our observations detected no ichthyoplankton were although samples contained numerous examples of zooplankton common to this lake. The species of zooplankton changed throughout the course of the study. Groups of Cladocerans and Copepods persisted mainly during the May and June months whereas *Chaoborus* became abundant in the late summer months (June-September) during which time the deep water at the intake contained less dissolved oxygen. Indeed, our samples occasionally contained small specimens of Asiatic clams and fragments of a large freshwater snail that has recently invaded Lake Hartwell. With the results from our study, we hypothesize water conditions around the intake may be unsuitable for potential ichthyoplankton, especially during the restricted time of water withdrawal, thus diminishing the concern of ichthyoplankton entrainment. More extensive and conclusive research has yet to be conducted.

P149 The Effects of Magnesium and Interstitial Space on Restoration Efforts Towards the Eastern Oyster, *Crassostrea virginica*

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Oysters serve as a quintessential keystone species through creation of habitat for themselves and other organisms, filtering seawater, and helping negate shoreline erosion. Oysters throughout the world have seen sharp population declines, including the Chesapeake Bay's Eastern Oyster, *Crassostrea virginica*, which has lost 90-99% of their population. This population decline stems from disease, pollution, and overharvesting. Restoration methods, such as the use of artificial substrates, are being used to help stimulate population growth and have been successful. However, other novel methods need to be examined for the species to recover. Such methods include manipulating the habitats' interstitial space to promote increased settlement and altering local mineral content in artificial substrates. The addition of magnesium has been shown to improve the health of other shellfish, and increased incorporation could lead to oysters that grow faster and are more resistant to ocean acidification. My intended research will test effects of oysters attaching to substrates with increased magnesium concentrations and varying interstitial spatial arrangements. In the Chesapeake Bay, artificial habitats will be constructed with different spatial arrangements, each containing natural oyster shell, concrete artificial shells, or concrete shells with additional magnesium carbonate. In addition, treatment shells with attached oysters will be subjected to steadily lowered pH in a lab setting to determine if increased magnesium incorporation leads to a resistance to ocean acidification. Ideally through this research, juvenile oysters will be shown to prefer habitats with smaller interstitial spacing, indicating a preference for environments that offer more protection, and show increased growth and health when attached to substrates with increased magnesium that they can incorporate. Should magnesium be found to improve the health of oysters, then introduced populations can be treated with the element to improve their chance of reaching self-sustaining growth levels, and in-turn improve the health of the entire Chesapeake Bay.

P150 Fish assemblage response to mitigation of a channelized stream reach in Tennessee

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Citico Creek is a third-order Ridge and Valley stream (tributary to the Tennessee River) whose watershed is located within the city of Chattanooga (Hamilton County), Tennessee. Water pollution issues have been documented at various mainstem and tributary sites in the Citico Creek system; these include, but are not limited to, elevated temperature, low dissolved oxygen (DO), high pH, nutrient enrichment, altered channel morphology and hydrology, impaired macroinvertebrate and fish assemblages, and high levels of pathogenic bacteria. In 2001, a local mitigation project - collaborative effort between the City of Chattanooga and two private entities - was completed to address water pollution issues in a channelized, concrete-lined stream reach (2nd order tributary) in the Citico Creek system. The mitigation involved removal of concrete from 925 m of the stream channel, followed by the installation of a series of rock weirs in the channel to promote grade and flow deflection. Erosion-control matting was installed along the banks and native vegetation was planted in riparian areas. We collected reach-level data on water quality, habitat, and fish assemblages in an unnamed tributary of Citico Creek before (1998-1999) and after (2008-2009) the mitigation. Before the mitigation, Western Mosquitofish (*Gambusia affinis* [Poeciliidae]) comprised 100 % of the catches. After the mitigation, catches were composed of 6 to 7 fish species, representing three families: Cyprinidae (1 species), Poeciliidae (1 species), and Centrarchidae (4-5 species). Index of biotic integrity (IBI) scores increased from 24 (rating = "very poor") to 32 ("poor"). Habitat improvements (removal of concrete, increased depth and pool habitat, addition of native riparian plants) correspond with increases in fish diversity and biotic integrity in the stream section; however, poor biotic health reflects the effects of catchment imperviousness (88% urban land) and reach-level habitat degradation (e.g., temperature >30.5oC, DO <5 mg/L, sedimentation).

P151 Population density and morphology of (Echinometra lucunter) Echinodermata: Echinoidea color morphotypes from different habitats along reefs in the southern Caribbean

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In high densities, Echinoderms can influence their ecosystems. In particular, sea urchins control any extensive algae growth, thus making it a key organism valuable to coral reef ecosystems. In the Caribbean, the rock-boring sea urchin (Echinometra lucunter) (Linnaeus, 1758) is commonly seen in marine habitats. These species specifically inhabit the intertidal zone on reefs along the north eastern coast of Trinidad, West Indies. We studied the distribution of two color morphotypes (black and red) in June 2015 and 2016. Quadrat sampling recorded morphotypes in habitats that experienced low and high wave action. Test diameter and weight were recorded in these habitats at Salybia Bay reef (SB) and Grande L'Anse reef (GA). Urchin densities at both sites averaged 18.3 (black) 6.2 (red) individuals per m^2 (N = 31 quadrats) and 24.2 (black) 6.9 (red) individuals per m^2 (N = 34 quadrats) in 2015 and 2016 respectively. Highest frequencies were recorded for urchins ranging between 21-40 mm in test diameter. Although both color morphotypes had significantly longer test diameters and weighed more in habitats exposed to low wave action than high wave action for both years, mean hard coral, soft coral, or algae cover did not show any relationship with habitat type.

P152 The Negative Effects of Gibberellic Acid (GA3) on Freshwater Daphnids' Mortality and Reproduction

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Scott Weir

Gibberellic acid (GA3) is a plant hormone commonly used in the agricultural industry to increase crop yield. Gibberellic acid is considered a crop additive and thus has been tested for acute toxicity by the US EPA as required by law. The EPA concluded that it was not hazardous to aquatic invertebrates because the LC50 concentration was above environmentally relevant levels. However, their conclusion came from an acute LC50 concentration of one aquatic invertebrate species ([Daphnia magna]). The purpose of this study is to expand upon their research due to the lack of data their report provides. This study used a modified EPA protocol for acute testing of crop additives on aquatic invertebrates. Buffered and unbuffered gibberellic acid solutions were used to determine if acidity was causing toxicity. [Daphnia pulex] were used alongside [D. magna] as a comparison to determine if they have different sensitivities to gibberellic acid. A chronic study was done as well using only [D. magna]. There was no statistical difference in LC50 concentration between the buffered and unbuffered solution for [D. magna]. This suggests that the toxicity of gibberellic acid comes from the structure itself and not from its acidity. There is also no statistical difference between the two species tested; although, the data suggest that [D. pulex] may be more tolerant to the compound. The mean number of offspring per replicate decreased at all concentrations in the buffered acute [D. pulex]. Sub-lethal effects could possibly be seen at environmentally relevant levels.

P153 Cold tolerance in introduced apple snails along a latitudinal gradient

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Island apple snails (Pomacea maculata) have been introduced throughout the southeastern United States. They can greatly reduce wetland vegetation necessary to maintain ecosystem structure and function. Pomacea maculata is larger and more fecund than the native apple snail that could result in a decline in native apple snail density. I will study the effects of temperature on the survivorship and growth rate of four different populations of P. maculata that span a latitudinal gradient from Georgia to South Florida. I predict that snails from more southern locations will have lower survivorship and growth at cold temperatures compared to those from more northern populations. To test this prediction, I will raise snails that were collected as egg masses from each population, at a range of temperatures that includes their lower lethal temperature. Growth and survivorship of individuals from each clutch and population at each temperature will be tracked. This research will help determine if populations of P. maculata in the northern part of their range can tolerate colder temperatures than populations in the southern part of their range as evidence for local adaptations. Evidence for cold tolerance adaptation would suggest their potential to migrate further north.

P154 Analysis of Bacterial Communities in the Sediments of Northern Gulf of Mexico and Effectsof Corexit® 9500A

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The Deepwater Horizon oil spill of 2010 resulted in the unprecedented use of dispersants Corexit® 9500A and 9527A. This generated the interest of scientists on the effects of dispersant on the biota of Gulf of Mexico. The Mississippi delta ecosystem in the Gulf of Mexico is extremely valuable to the U.S. economy providing goods and services worth $12 to $47 billion annually. Additionally the bacterial community there is important as a food source to various marine organisms, which forms the basis of the food chain. In the first study in this thesis, sediment samples from the Gulf of Mexico, Lake Pontchartrain, and Dauphin Island were studied for the change in bacterial communities under 0%, 0.02%, and 0.2% Corexit® 9500A incubated for 14 days. The V3 region of the bacterial 16S rRNA gene was amplified via PCR and run through DGGE. A phylogenetic tree was generated by analyzing the DGGE image using PyElph software. Results showed that the effect of 0.02% Corexit was negligible, but 0.2% Corexit changed the benthic bacterial community. This suggests that Corexit® 9500A application may affect the indigenous bacterial community within 14 days of its application, depending upon the rate of dilution in the water column. In the second study, benthic bacterial communities from fourteen sites along the continental shelf of the Gulf of Mexico were analyzed to find out if environmental factors correlated with the bacterial community structure. The results showed that the bacterial communities to the east of the Mississippi River were significantly different from the west, which were influenced by the river and more closely grouped.

P155 A Survey of Large-Size Mammal Diversity and Abundance in the Temperature Forests Located in Rural, Suburban, and Urban Parks in Northern Georgia using Multiple Types of Lures and Trail Cameras

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This study examines large size mammal (e.g. deer, rabbit, fox, etc.) diversity and abundance in the temperate forests of Georgia. Human settlements and man-made structures have depleted the native wildlife habitat, leaving limited habitat available in state parks and private reserves. The objective of this study was to investigate and measure the diversity and the abundance of large-size mammals in forests located in urban, suburban, and rural state parks. Is there a relationship between mammal diversity and abundance and the density of human populations? Would forests in rural areas contain more mammal species or have greater abundances of certain mammal species than suburban or urban forests? Can we effectively measure mammal populations with trail cameras? Do certain types of animal lures attract different mammal species with greater efficiency than others? Nine state parks (3 rural, 3 suburban, and 3 urban) were selected for the study. At each park, we placed twelve DLC Convert II digital infra-red trail cameras pointing toward a scent lure. The 12 camera sites at each park were checked weekly, and the lure was refreshed each week. Cameras were left for 2 weeks at each location. There were four lure types used at each park (3 replicates per park). A variety of species were captured by the cameras including: whitetail deer, opossum, squirrel, rabbit, armadillo, grey and red fox, raccoon, coyote, bear, and bobcat. The data from both suburban and rural state parks indicated that both of these areas are suitable environments for large-size mammal species. Urban parks had a significantly lower abundance and diversity of large-size mammals. For conservation purposes, undeveloped rural and suburban temperate forest areas need to be protected, perhaps as county or state parks, in order to safeguard large mammal diversity and abundance.

P156 Microclimate Gradients and Their Relationships to Terrestrial and Subterranean Biodiversity along the High Knob Landform, Virginia

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The Big Cherry Lake basin on the High Knob Massif, situated atop the Cumberland Overthrust Block, is part of the wettest terrain in Virginia. The basin includes high valley wetlands, whitewater creeks and the Omega Cave System, the deepest cave system in North America east of the Mississippi River. The massif drains into one of the most aquatically diverse rivers on the continent, yet little work has been done to determine how microclimate gradients influence terrestrial and subterranean biodiversity. A mesonet for defining temperature and moisture gradients in this complex terrain is being developed in order to better understand relationships between terrestrial and subterranean biodiversity and microclimate conditions. Initial work centers around deployment of temperature and relative humidity sensors installed at sites selected to capture both horizontal and vertical changes in conditions between forest, forest edge, and open habitats within high valleys and across different exposures along mountain slopes-ridges and cold air drainage corridors at varied elevations. Data from these sites, combined with data being recorded inside the Omega Cave System, will enhance understanding of the complex, three-dimensional terrestrial-subterranean interaction between microclimate and biodiversity. Analysis of these data is expected to identify temperature and humidity controls on species distribution and biodiversity in the study area. This information will provide insight into how microclimates may have created refugia for species surviving past climate change and how they might aid species survival in the future.

P157 Multi-year Comparative Analysis of Maple Species for Syrup Production

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Sugar maple (Acer saccharum) is a key cultural resource from northeastern Canada to the southern Appalachians. Following current projections of climate change, this cultural icon may be threatened with population range shifts, decreased health, lower sap volume, and inferior sap quality. This may be particularly relevant in the southern extent of its range in the Southern Appalachian Mountains. To help adapt to these changes, some producers have begun tapping alternative maple species that may be more resilient to climate change, including Red Maple (Acer rubrum), Box Elder (Acer negundo), or Silver Maple (Acer saccharinum). During the spring of 2016 and 2017, data was or will be collected on sap volume, quality, and sugar content for each species. Sap quality will be quantified by looking at antioxidants, total phenolic concentrations, and concentrations of maple flavor compounds. Sugar content is quantified in units of Brix using a field refractometer. Current results suggest that there may be several viable alternatives to Sugar Maple for the production of maple syrup, most notably Box Elder, which had the highest sap yield when compared to other species, producing almost double the sap of other species, with an average of 23.80 kg per tap. The sugar concentration of Sugar Maple and Silver Maple sap was around 20% more than the concentrations from Box Elder and Red Maple sap. Results thus far suggest that diversifying maple species as sap sources may be a viable strategy of climate change adaptation for the maple syrup industry.

P159 Seasonal Abundance and Habitat Selection of Chiropterans at Felsenthal National Wildlife Refuge in Southeast Arkansas

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Chiropterans (bats) are the second largest taxonomic order of mammalians on earth, second only to rodents. Felsenthal NWR is a ~65,000 acre refuge composed of three distinct habitat types: bottomland hardwood forest, cypress-tupelo swamp, and upland pine forest systems. Up until 2015, mobile acoustic monitoring was done only twice annually to account for the presence of bat species and to record and compare abundance to years prior. During the summer of 2014, it was discovered that the northern long-eared bat (Myotis septentrionalis) was present on the refuge. The northern long-eared bat was recently listed as "threatened" by the U.S. Fish and Wildlife Service, and this location is believed to be outside of its geographic range. Over the course of 18 months, we are utilizing acoustic monitoring, mist netting, and tree cavity searches to record bat species present throughout the three habitat types present on the refuge. Mobile and passive acoustic surveys are being used to measure bat abundance and their habitat selection and utilization on the refuge. Mist netting is employed to confirm our acoustic samples of bat echolocation calls and document the habitats in which they are found. All bats collected in mist nets are screened for white-nose lesions. Tree cavity searches are performed to identify roost sites, maternity colonies, and hibernacula preferences. Results for data collected through the month of March 2017 will be presented.

P160 The Important of Abundance to Local Extinction Caused by a Disturbance in Freshwater Communities

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The role stochastic processes play in determining a species' likelihood of local extinction in the face of disturbance is rarely considered among conservation biologists. If chance-based events prove to be strong predictors of extinction risk, then species rarity should have a larger influence in the implementation of future conservation policy. To determine the relative importance of species abundance in response to generalist predation, we used a null model approach to analyze local macroinvertebrate extinctions in a series of mesocosms that were treated through the addition of predatory green sunfish (*Lepomis cyanellus*). Each mesocosm was surveyed for macroinvertebrate diversity once prior to the addition of fish, with two surveys being conducted four and six weeks after the introduction of green sunfish. Our null model follows a rarefaction approach that assumes species loss is determined by the random removal of individuals following a disturbance. If observed extinctions are not statistically different from those predicted by the model, then this suggests that extinctions are primarily stochastic events. Extinctions that deviate from these expectations provide evidence for selective processes occurring. Preliminary results suggest that many of the observed extirpations could not be distinguished from those simulated by the null model, meaning extinctions were largely stochastic. However, there were a number of species' declines that deviated from our null expectations, suggesting that certain taxa may vulnerable to deterministic mechanisms of extinction.

P161 Chemotypic diversity of ginsenosides in American Ginseng (*Panax quinquefolius* L.) in Western North Carolina

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American ginseng (*Panax quinquefolius* L.), a perennial herb located in the eastern United States, is threatened by overharvesting and climate change. Ginsenosides, the plant's secondary metabolites, give the plant its medicinal qualities, which make it sought after in Asian markets. Knowing ginsenoside profiles within populations would aid in creating cultivars characterized by their specific medicinal properties. Ideally, this would lessen the demand for wild harvested roots and preserve dwindling populations. Genetic diversity of the plant is assumed to be extensive in the Appalachian region, as a result of the glacial refugia created during the last ice age. If ginsenoside production is linked to microsatellite markers, the chemotypic profile may also be widely diverse in the region. Ginsenoside profiles were analyzed in 178 roots from 17 WNC populations and 2 Virginia populations. Six ginsenosides (Rb1, Rb2, Rg1, Re, Rd, and Rc) were characterized and quantified using methanol-reflux extraction and high performance liquid chromatography (HPLC). Preliminary analysis has proven variation in chemotypes, with most plants exhibiting RG (Re/Rg1 < 1) chemotypes and only a few populations showing RE (Re/Rg1 > 2) or Intermediate (1 < Re/Rg1 < 2) chemotypes; this could be a result of outplanting commercial seeds.

P162 Assessing Reproductive Potential in a Federally Listed Species: Differential Pollen Viability Staining of *Spiraea virginiana*

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Matt Estep

Spiraea virginana Britton (*Rosaceae*) is a federally-listed rare, clonal shrub that inhabits riparian zones within the Ohio River drainage. The species often occurs in areas of high disturbance and predominantly uses asexual reproduction to propagate from populations upstream. Although the species' known range suggests that sexual reproduction played an important role in its evolutionary history, sexual reproduction is currently almost non-existent. Pollination studies have shown that the species can produce fertile seeds; however, this has not been witnessed in wild populations. Determining the role of pollen viability in the lack of fertile seed formation is an important step towards understanding the sexual reproductive barriers experienced in this species, possibly allowing for updated restoration efforts to be introduced. Pollen viability was determined through *in vivo* studies utilizing a modified Alexander's stain that differentiates viable and aborted pollen. Inflorescences were collected before anthesis while pollen was mature but anthers were non-dehiscent from populations along the south fork of the New River and Cheoah River in North Carolina. This study aimed to assess and determine the percentage of viable pollen produced among populations that were collected along these river drainages in order to help determine if pollen viability is a major contributing factor to sexual reproductive barriers within this species.

P163 Determining Potential Effects of Vertebrates on Rare Plant Communities using Trail Camera Technology

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The Tater Hill Plant Preserve is a conservation property managed by the North Carolina Department of Agriculture for the specific purpose of protecting plant diversity. The 1200 acre preserve contains multiple Southern Appalachian plant communities including; a Grassy Bald, a High-Elevation Rock Outcrop, a High-Elevation Red Oak Forest, Northern Hardwood Forest (including a Beech Gap), and Mountain Bogs. These unique communities collectively contain more than 40 species of rare, threatened or endangered plants. One of the first steps in managing rare plant populations is to assess any threats to their long-term survival. The aim of this study is to census vertebrate populations and species composition in the preserve to identify any threats they might pose to plant populations. The project uses 12 Cuddeback Long Range IR trail cameras moved to new locations every month for 12 months creating 144 different sample locations producing approximately 4,380 camera sampling days. Camera location was determined by using third party ET Geo Wizard tools and extensions along with parcel fabric extensions, allowing us to array the cameras across the landscape in an unbiased manner. The preserve has been divided from north to south into 12 equally proportioned areas that are defined as camera sites. The extensive amount of sampling should allow for a better understanding of how each community type is being used by large vertebrates and increase the statistical power of the study. The study will examine the home range of animals that make the preserve their home, while also assessing the number of animals passing through the preserve during certain times of the year for feeding or mating purposes. The results of the study will provide the necessary data needed to make management decisions for protecting, and preserving rare plants within the Tater Hill Plant Preserve.

P164 Post Restoration Decline of Outplants in a Threatened Hawaiian Dry Forest Ecosystem

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Hawaii, often referred to as the endangered species capital of the world, also hosts one of the world's most threatened forest types: tropical dry forest. Outplanting is one conservation strategy used to reintroduce species to help restore diversity in threatened habitats. Despite the frequency of outplanting efforts in the state of Hawaii, little is known about the density and diversity of outplants and the survivorship of outplants over time. Conservation biologists at the Puuwaawaa Dry Forest Reserve on the leeward side of Hawaii Island have engaged in outplanting over the last 6.5 years. Fifty-two species of endemic or indigenous Hawaiian plants have been planted in a 50-acre fenced and ungulate-free site since 2010. A survey of these outplanting areas was first conducted in 2015 using transects and quadrats to quantify the diversity and density of outplants throughout the plant reintroduction site. A second survey was conducted in 2016 using these same transects. Here we present comparisons of the species richness, diversity, evenness, density, and survivorship between the two surveys at Puuwaawaa after a period of 13 months. Trends showed an overall decline in density, diversity, and richness between the two survey periods, with an average survivorship of 56.45%. Akoko (*Euphorbia olowaluana*) was the only species that increased in number over the survey period. In conclusion, density, diversity, richness, and survivorship demonstrated negative trajectories over a relatively short time period. These results suggest that multiple plant reintroductions may be needed to maintain or increase diversity and richness of restored tropical dry forest areas. Moreover, more native species that have high survival and reproductive rates, such as akoko, may need to be planted in dry forest restoration projects to reverse post-restoration declines.

P165 Re-establishment of a Piedmont prairie by disking and seeding

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David Vandermast

Prairies are less common habitats in the eastern US than they once were due to fire suppression, transition to agriculture, and development. In 2014 a < 1 hectare (ha) a field at Elon University's Loy Farm was disked and seeded with 16 common and native vascular plant species in order to establish prairie habitat. Our goal was to determine the success of this method of establishing prairie plants on a former agricultural field. After disking and seeding, five 10x10 m modules were established to collect data on species richness and cover (% of the module covered by each species). In addition, soil nutrients and texture were analyzed by Brookside Labs, New Bremen, OH to determine the effect these variables have on prairie plant establishment. We identified 89 vascular plant species growing in the prairie, including all seeded species and 18 invasive species. We found a significant negative correlation between vascular plant species richness and cover (r2=.98). Higher cation concentrations were associated with plots with higher cover, but not higher species richness. Soil nutrient concentrations varied across the field, particularly near plot 1 where organic matter (5.6% vs 2.6%; p=0.005), total exchange capacity (10.2 vs 4.4 meq/100g; p=0.0004), and concentrations of soil cations such as were significantly higher than elsewhere in the prairie. Our results indicate that disking and seeding a former agricultural field can result in the establishment of the seeded species. However, we also found that increased nutrient availability, especially in the form of cations, results in high cover values but does not increase species richness. Additionally, ongoing management of the field is necessary to limit invasion of non-native species.

P166 Effects of Reforested Riparian Zones in an Agricultural Matrix on Bat Communities

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Bat conservation must occur in multiple habitats beyond national parks and protected forests if the ecosystem services bats provide are to be protected. One of the leading causes of habitat loss is deforestation for agricultural use. As wildlife habitats continue to be increasingly influenced by anthropogenic factors it is imperative that research continues to guide conservation efforts and to both promote wildlife species and their ecosystem services. Different conservation strategies have been proposed to promote wildlife in agricultural landscapes, including the Conservation Reserve Enhancement Program (CREP) in Virginia. However, there has been little published concerning bat conservation in riparian forests established through CREP or its counterparts in other states. This research project will help inform stakeholders and government agencies as to the efficacy of CREP in promoting bat diversity and activity. Riparian areas within CREP Farms are restored with native tree species and fenced off from cattle to improve water quality, soil properties, and wildlife habitat. While water and soil have been well studied, we do not know CREP's impact on bat communities. Acoustic detectors will be used to determine if CREP sites (compared to control sites with deforested riparian areas) promote bat diversity and activity. Insect diversity will also be quantified with black-light surveys to provide additional information on whether CREP promotes prey populations of bat species. An additional parameter of CREP that will be analyzed is percent canopy cover. It is expected that both of these characteristics promote bat populations within CREP riparian zones. The hypothesis of this study is restored riparian forests within an agricultural matrix provide bat species with improved feeding options and covered corridors between habitats. This project aims to

estimate the efficacy of CREP in promoting bat species, identify the current benefits CREP provides bat species, and to guide future conservation efforts.

P167 Waterfowl Diversity on Former Surface Mines in the Virginia Coalfields

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Walter Smith

The heart of the Appalachian Mountains in southwest Virginia is a well-known hotspot of biodiversity for several taxonomic groups, including freshwater mussels and amphibians, among others. While much of this region's aquatic biodiversity has been heavily studied, less is known about taxa that rely on this region for overwintering and/or as stopping points along migratory pathways. In particular, migratory waterfowl use this area's beaver ponds, riparian wetlands, and constructed ponds on former surface mines as habitat. To date, however, little to no knowledge of the waterfowl species which utilize these areas for both breeding and migration exists. We performed ground-based point surveys using both field visits and game cameras at various ponds and wetlands across Wise County, Virginia to confirm waterfowl species presence across the Virginia coalfields, placing a specific emphasis on wetlands located in surface mine complexes on the Appalachian Plateau. These surveys are ongoing, although results to date have confirmed the presence of multiple species expected to occur within the study region, as well as other species, such as the Snow Goose, which are considered to be uncommon in or absent from the region by various sources. Our work provides for a foundation for future research involving waterfowl species on Virginia's Appalachian Plateau and their associations with both natural and constructed wetland habitat features across this region.

P168 Viability and germination of *Buckleya distichophylla* (Santalaceae) seeds from Virginia

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Ryan Huish

Buckleya distichophylla (Santalaceae), commonly known as piratebush, is a rare dioecious and hemiparasitic shrub endemic to the Appalachian Mountains of Virginia, North Carolina, and Tennessee. Ongoing studies by the authors are documenting the reproductive biology of this species in its densest population, that of Poor Mountain in southwest Virginia. Here we report on initial results of viability and germination tests conducted on seeds collected during the summer of 2014. Viability of seeds was determined using a standard 0.1% 2,3,5-triphenyl-tetrazolium chloride (TCC) solution, which tests for embryo respiration. Seeds from 19 individuals were included in the germination tests. In addition to controls, seeds were separated into groups and either: 1) bathed in 2.6% sodium hypochlorite solution for 10 minutes and rinsed, 2) bathed in 2.6% sodium hypochlorite solution for 60 minutes and rinsed, or 3) subjected to scarification via removal of a portion of the seed coat. The sodium hypochlorite solution served the functions of preventing excessive fungal growth and acting as a chemical form of scarification. Before the above-mentioned manipulations were conducted, half of the fruits were submitted to a cold period to test for the necessity of seed stratification in breaking seed dormancy; the other half was not stratified. Seeds were then placed in potting soil to allow for germination. Results of these experiments are currently being analyzed.

P169 A Review of Red-cockaded Woodpecker Management Strategies and Factors Affecting their Population Growth

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Paige Ferguson

The Red-cockaded Woodpecker, *Picoides borealis* (RCW), is a federally endangered species endemic to pine forests of the southeastern USA. Their unique ability to excavate cavities in living pine is critical to providing nesting habitat for other cavity nesters in fire-dependent Longleaf Pine (*Pinus palustris*) forests where dead trees are scarce. To ensure RCWs and other cavity nesting species thrive in Longleaf Pine forests, RCW populations require adaptive management. To determine knowledge gaps in RCW research and aid managers with their recovery, we reviewed scientific literature and technical resources (e.g. books and symposia) that examine both the efficacy of RCW management strategies and how habitat characteristics and other factors influence RCW reproduction, survival, or dispersal. We defined management strategies as effective if more than 75% of papers found it significantly improved ($p<0.05$) RCW population size and ineffective if more than 75% of papers indicated the strategy did not significantly improve ($p>0.05$) RCW population size. Our findings suggest RCWs select nesting habitat, foraging habitat, and dispersal corridors comprised of old growth pine and avoid areas with greater amounts of hardwood midstory. In addition, the presence of RCW helpers at nests tends to increase the number of fledglings produced. Our study also suggests that the most effective RCW management strategies were cavity installation, raking around nest trees prior to prescribed burning, and RCW translocation. Certain management strategies, such as the use of shelter wood harvest to improve RCW habitat, require further study to determine their efficacy. Removal of Southern Flying Squirrels (*Glaucomys volans*) from RCW cavities did not significantly improve RCW fledging rate ($p<0.05$). Our findings also suggest certain areas in the RCW's range, such as districts in the Talladega National Forest, require further study as do the mechanisms underlying breeder health and adult and juvenile mortality.

P170 Partial root harvest of *Panax quinquefolius* L. (American ginseng): a non-destructive method for harvesting root tissues for ginsenoside analysis.

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Panax quinquefolius L. (American gineseng) is an economically important herbaceous woodland perennial plant native to eastern North America. The roots have long been prized in Asian medicine, and are beginning to be used more in North America and Europe for herbal supplements. This use has led to an increased demand for the roots of this species, resulting in overharvesting, increasing rarity, and loss of genetic diversity in much of its native range. Much research is being directed at ginsenosides, the triterpenoid saponin glycosides that are the major active medicinal compounds found in ginseng. Given the conservation concerns regarding wild *Panax quinquefolius*, we began experimenting with a partial root harvest method in 2014 for extracting tissue for ginsenoside analysis without killing or causing long-term harm to the plant. Partial root harvest samples were taken from 13 wild populations throughout Western North Carolina. Preliminary results revealed that 51 of the 55 (93%) plants subjected to partial root harvest in 2014 resprouted in 2015 and three of the four plants that did not emerge in 2015 resprouted in 2016. Of the 46 plants sampled in 2015, 43 (93%) emerged in 2016. These results suggest that this method could prove to be an effective way for ginsenoside researchers to mitigate their impact on wild ginseng populations. Because aboveground herbivory has been shown to influence plant size in

subsequent years, we will also compare morphological characteristics (size, number of leaves, reproductive status) before and after partial root harvest to determine the effect of partial root harvest on morphology and reproductive output.

P171 A comparison of bat activity at an urban and a rural pond in northwest Tennessee

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Bats may use urban ponds as a source of water and emergent insects, but urban ponds may not provide suitable roost trees that are more common in rural environments. Our hypothesis was that bat activity would be affected by location, time of year, time of night, and temperature. We predicted that lower bat activity would occur at the urban pond, be lowest in early spring and late fall regardless of location, and be lower at lower temperatures regardless of location. We monitored bat activity at a pond on the UT Martin campus and at a pond in a rural setting near campus via bat detectors with an internal thermometer late March-late April and late September - October 2016. Given the amount of activity at both the small urban pond and the rural pond, these aquatic resources may be very important for bats, especially when they are migrating to their summer and winter roosts.

P172 Identifying Evolutionarily Significant Units in *Spiraea virginiana* along the New and Cheoah Rivers in North Carolina

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Spiraea virginiana Brit. (Rosaceae) is a rare clonal shrub found in isolated populations within the Cumberland, Tennessee, and Ohio River drainages. This species has been listed as federally endangered since June 1990 due to anthropogenically induced habitat loss and population fragmentation as a result of river damming. Reproduction consists of a mixed mating system that is mostly asexual by ramet formation, with occasional dispersal via vegetative fragmentation downstream. Successful sexual reproduction is limited, and could result from self-fertilization or outcrossing. The species does appear to outcompete other shrub species by vigorous rhizome production and its ability to withstand scouring floods. The lack of sexual reproduction could potentially result in an extremely limited effective population size in each river. This study aims to assess the genetic diversity of *S. virginiana* populations along the New and Cheoah Rivers in North Carolina using eight previously published microsatellite markers. Our results suggest a small effective population size within each of the two rivers. These results are consistent with earlier investigations and could have management implications, possibly treating each river drainage as its own evolutionary significant unit for (ESU).

P173 Conservation Genetics of the Shale Barren Leatherflowers (*Clematis*)

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The shale barren leatherflowers (*Clematis viticaulis*, *C. albicoma*, and *C. coactilis*) form a species complex that is restricted to a small, fragmented range in the Appalachians of western Virginia and eastern West Virginia. They are endemic to uncommon xeric habitats called shale barrens that occur on steep, shaly, exposed south-facing slopes. Because of their narrow ecological niche and

restricted geographical distribution these species are particularly vulnerable to climate change and habitat destruction. Characterizing genetic diversity within the complex is an important component of conservation efforts, and will also resolve questions about the evolution and history of the group. Our research aims to answer three fundamental questions: 1) how much genetic diversity exists within shale barren leatherflower populations, 2) how genetically divergent are leatherflower populations from one another, and 3) how are the three leatherflower species related to one another? In order to answer these questions, we have developed a panel of microsatellite markers suitable for use in genotyping individuals of all three species. We present preliminary data from 18 populations representing the entire complex, consisting of genotypes for a small number of initial loci. Populations show substantial allelic richness at these loci, and there is surprisingly low divergence among populations, regardless of species.

P174 The Search for a Missing Mouse in Eastern Alabama

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The meadow jumping mouse (MJM; *Zapus hudsonius*) is a species of conservation concern throughout the Southeast due to lack of information about its current range and population size. Our primary objective was to begin assessing the occurrence of MJM in Alabama. As a secondary objective, we compared the trapping efficiency of Sherman live traps and sooted track tubes. Sites were selected based on historical records and presence of suitable habitat for the species determined from an ArcGIS database and Google Earth imagery. Jumping mice inhabit areas with moist soils and dense cover of predominately herbaceous to shrubby vegetation. Therefore, our study focused on abandoned hayfields and grassy meadows along marshes, ponds, and streams. During summer 2015 and 2016, 34 sites were sampled with trapping grids that alternated live traps and track tubes among trap stations. We did not capture or detect any MJM. We found no significant difference in trap efficiency between the three most common species (*Sigmodon hispidus*, *Oryzomys palustris*, and *Peromyscus*) detected by both trap types. However, track tubes accounted for more overall detections and detected more species than live traps, including shrews, rabbits, and herpetofauna. Given the sporadic nature of previous MJM captures, it is unknown whether the species has declined in Alabama. For future studies of this species in Alabama, we intend to extend the geographic scale and increase trapping effort to provide further information about the MJM's current population and range throughout Alabama.

P175 A study of Autumn Olive (*Elaeagnus umbellata*) and some mechanisms involved in its invasion of an Appalachian forest understory

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Howard Neufeld

Autumn Olive (*Elaeagnus umbellata*) has invaded a large portion of the Appalachian State University Nature Preserve in Boone, NC. This species is one of the most invasive woody plants in the eastern United States, especially in high light conditions. Its ability to colonize and take over shady, understory habitats in the southern Appalachians has not been well investigated and the mechanisms by which it becomes invasive are not understood. Both phenological and ecophysiological characteristics may contribute to the invasiveness of this exotic species. For example, compared to native understory plants, autumn olive may leaf out earlier in the spring and hold onto its leaves later into the fall. This would enable

it to take advantage of the high light conditions during these times, possibly giving it an advantage over native species. Phenological measurements were made last fall and a Li-6400 gas exchange system was used to determine photosynthetic rates in the understory. Autumn Olive retained 28% of its leaves through the 17th of November, while other understory plants lost all of them by the end of October. Over this same interval light levels in the understory rose as the canopy lost its leaves, and so did photosynthetic rates. In late September, when the canopy was still mostly intact, light levels were 299.8 µmol m-2 s-1 and photosynthetic rates ranged from 3.8 to 6.5 µmol m-2 s-1. After canopy leaf fall in early November, light levels rose to 1499.8 µmol m-2 s-1 and rates of photosynthesis were as high as 9.4 µmol m-2 s-1. Thus, this species can maintain an extended phenology in the fall and obtain relatively high rates of carbon gain while native plants are dormant. This coming season, detailed phenological and gas exchange measurements will be made to further document the mechanisms governing invasiveness in this exotic species.

P176 Dendrochronology and ecophysiology of Fraser firs (*Abies fraseri*) along an elevational gradient in the Southern Appalachians

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Zane Sink, Howard Neufeld

The native range of Fraser fir (Abies fraseri) is restricted to just seven cool, moist southern Appalachian mountaintops at elevations above 1524 m; however, they are grown commercially for Christmas trees at elevations as low as 670 m, where conditions are much warmer and drier. This restriction of the native range to high elevations suggests a sensitivity to warming and/or drought. We used elevation as a surrogate for warming to investigate physiological and growth responses of these trees over a range of elevations from 664 m to 1228 m. If trees at lower elevations are subject to greater physiological stress due to higher temperatures and drier soils, then they may suffer from temperature and/or water stress and have a higher water use efficiency due to stomatal closure. Therefore, we predicted that low elevation trees would produce smaller annual growth rings and have a lower discrimination against 13C (less negative δ13C values), which is indicative of higher water use efficiency. Tree cross-sections were collected from farms at three elevations (two farms/elevation) and measurements of annual growth ring circumference and corresponding area made with a microscope and digitizing software. Needle samples from the same tree farms were collected at the end of the 2014 growing season and sent to the stable isotope analysis facility at Northern Arizona University to determine δ13C. The stable isotope analyses showed no significant differences in δ13C among trees at different elevations, leading us to reject our hypothesis of greater water use efficiency at lower elevations. Growth ring analyses are currently underway and will be reported at the meeting. These results will provide information on the physiological effects of warming on Fraser firs and their possible implications for the future of the Christmas tree industry in the mountains of North Carolina.

P177 A Multi-Year Examination of Seasonal Body Size Changes in Bumblebees and Carpenter Bees During the Growing Season (March-September)

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Mark Schlueter

Eusocial insects, such as some hymenoptera, are known to distribute the work load of the colony by means of a caste system. While size variation exists between castes in most of these insects, within castes the size of individuals is relatively static. However, in the bumble-bees (Aculeata: Apidae: Bombus sp.) there exists

considerable size variation among workers (from a seven to ten-fold difference). This intra-caste size polymorphism is completely random this variation is consistently distributed intra-colonially. The worker polymorphism within Bumble Bee communities is not determined by colony age (seasonal colony cycle), colony size, nor is caused as a result of resource availability. All studies to date are based off thoracic measurements using a standard tegula (wing-base)-to-tegula measurement for establishing individual bee sizes. In this study, wild collected bumble-bees (Bombus impatiens) and carpenter bees (Xylocopa virginica) were sampled throughout the growing season (March-September) for 5 consecutive years (2010-2014). Contrary to previous studies, these bees are random caught specimens with unknown colonial (B. impatiens) or nesting locality relationships. The solitary carpenter bee (X. virginica) serves as a control versus bumble-bees, as there are not colonial relationships shared among individuals. Rather than utilizing thoracic dimensions alone to determine size variation, head and wing dimensions were also analyzed to compare size polymorphism among bumble bee workers and both genders of carpenter bees. Comparisons from these measurements were made between: (1) genders; (2) seasonality; (3) level of sociality; and, (4) between species. Individuals were accurately measured using a 0.001mm resolution digital caliper, and focused upon (1) fore- and hind-wing surface area, (2) head size, (3) thorax size, and (4) abdomen breadth. Anatomical changes over the course of the growing season, across multiple years and sampled within identical locations will be quantified and the data elucidated upon to establish a baseline for future Bombus research.

P178 Comparison of Spider Species from Adjacent Mesic and Xeric Habitats in Pike County, Alabama

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Information about Alabama's Aranae fauna is lacking, and estimations of diversity vary from 580 to 1000 species within 42 families. The most recent surveys were carried out in the 1940s and focused on three families. Diversity studies in the United States and Europe indicate that spider diversity is closely related to habitat and plant diversity. Alabama's many ecoregions and diverse flora should also support a high number of species. This study's focus was on the spiders inhabiting the xeric and mesic ravine areas of the Pike County Pocosin Nature Preserve in Pike Co., Alabama, which represents a sand-hills ecosystem. The xeric area is a longleaf pine [Pinus palustris] plantation treated with fires and dominated by herbaceous vegetation. The ravine area is dominated by hardwoods, has little herbaceous growth, and is relatively undisturbed. Pitfall traps, a sweep net, a beating sheet, a bug vacuum, and an aspirator were used to collect spiders from October 2015 until May 2016. A total of 1,224 spiders were collected. The mature individuals represent 82 species in 24 families. Fourteen of these species are new records for the state of Alabama. Over half of the spiders were from the xeric area, and 61.0% of all specimens were male. Pitfall traps were the most successful collection method and accounted for 87.7% of captured individuals. The abundance of herbaceous vegetation in the xeric area appears to be preferred by the spiders over the ravine area's stability.

P179 Inbreeding Depression in the Introduced Spider *Latrodectus geometricus*

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Scott Harrison

The brown widow spider (*Latrodectus geometricus*) is thought to be native to South America or Southern Africa, but its distribution has expanded to most continents by human introduction. In the continental USA, *L. geometricus* was first documented in south Florida in the 1930's. In the early 2000's a population expansion occurred, and this species is now found in Florida, Georgia, South Carolina, Alabama, Mississippi, Louisiana, Texas, and southern California. Introduced species may face many obstacles when establishing a new population. One common obstacle might be severe inbreeding following founder events or genetic bottlenecks. The purpose of this study was to quantify inbreeding depression in an introduced population of *L. geometricus*. We predicted that if inbreeding was common during introduction, deleterious alleles should have been purged resulting in lower genetic load and consequently minimal fitness differences between inbred and outbred offspring. To assess the consequences of inbreeding, we compared hatching number between clutches produced by full-sibling crosses and crosses between unrelated individuals. The the percentage of unhatched eggs/clutch was roughly 3-fold higher in inbred relative to outbred offspring, indicating a fitness cost to inbreeding. The results suggest that significant inbreeding has been avoided during the introduction of this species in the southeastern US. This may be the result of multiple and continued introductions being common during the recent range expansion leading to a minimization of inbreeding.

P180 Bee abundance across forest canopy types in timber harvest areas

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As insect pollinator populations continue to decline due to global changes, it is essential that pollinator vegetation environment is responsibly managed. Though critical, insect pollinators are often overlooked by forestry practices. Without a thorough understanding of how forestry management practices affect insect pollinator communities, the impacts to plant communities from these practices cannot be fully appreciated. Within forested areas, bees are major contributors to pollination, which contributes towards succession after timber harvests. Knowing if bee abundance changes across forest canopy types (clear cut, edge, forest interior) in areas subject to silvicultural practices is important in the world of modern forestry to ensure healthy succession and regrowth of forests. In this study, bee abundances are measured in cut patches, forest edges, and the forest interior along transects within the North Carolina Nantahala National Forest timber harvest areas. Bees were collected using yellow, blue, and white pan traps in the summer of 2016. Bee species abundance was estimated for each sampling point, and abundance among the three forest canopy types were compared using community analysis metrics. Preliminary analysis of subsets of data suggest that although the highest numbers of bees were found in gaps and the fewest were found in forest interiors, there was no significant difference in bee numbers across forest canopy types. Further examination will determine if there is a difference in bee species richness and diversity across forest canopy types in these timber harvest areas.

P181 Reproductive Effort and Output in Two Species of *Sarracenia* (Pitcher Plant) and Their Hybrids

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Sarracenia jonesii (Wherry) (mountain sweet pitcher plant) and *Sarracenia purpurea* var. *montana* (D. E. Schnell & Determann) (mountain purple pitcher plant) are two morphologically distinct species of carnivorous plant endemic to the Appalachian region of North and South Carolina. Like other Sarraceniaceae, these species are known to hybridize in sympatry, but fitness differences among the taxa remain uncharacterized. In this study, we examined reproductive effort and reproductive output of *S. purpurea* var. *montana* in sites where it is the only member of its genus, and in sites where it co-occurs and hybridizes with *S. jonesii*. In summer 2015, ovaries, anthers, and later seeds were collected from 8 western North Carolina sites: 4 with only *S. purpurea* var. *montana*, 3 with both species, and 1 with both parental species and their hybrids. All ovules were enumerated with light microscopy under 10X magnification, and a subset of pollen grains were counted in a hemocytometer under 40X magnification. Seeds were tested for viability using tetrazolium, or stratified and then germinated in a controlled climate growth chamber. Data were transformed to ensure normality, then analyzed using ANOVA with Tukey's studentized range test (ovule and pollen counts) or Kruskal-Wallis tests followed by Dunn's tests (seed counts, seed viability, and seed germination). While seed production varied significantly among sites, viability and germination did not. Ovule counts varied significantly among parent species and hybrids, with hybrids producing more ovules than *S. jonesii*. Pollen counts also varied significantly, with *S. purpurea* var. *montana* producing more pollen than *S. jonesii*. However, seed counts, viability, and germination did not vary significantly among parental species or hybrids. Future experiments will examine the genetic composition of hybrid plants, to determine their generation. Abiotic and biotic reasons for differences in seed production among sites but not species are also being explored.

P182 Evolutionary Biogeography of the White-Browed Laughingthrush in China's Sichuan Basin

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It is widely accepted that geographic complexities have influenced the evolution of distinct lineages by periodically isolating populations during historical climatic fluctuations. The Sichuan Basin is a globally recognized biodiverse eco-region characterized as a continental island isolated by mountainous topography. Such geo-physical complexity creates a unique landscape feature that has likely facilitated the present patterns of biodiversity in and around the Sichuan Basin. While the topography of neighboring regions has been recognized as factors shaping biodiversity, the Sichuan Basin has received little attention regarding its role in influencing local biogeographic patterns. The White-browed Laughingthrush (Garrulax sannio) is both abundant and widely distributed throughout much of southern Asia, making this species an appropriate model organism to demonstrate the role of the Sichuan Basin in influencing biogeographic patterns in this region. Through phylogenetic analysis of RADseq data I will investigate the genetic structure and estimate periods of historical isolation among populations of G. sannio in and around the Sichuan Basin. I will utilize morphological data to detect patterns of geographic variation in morphology along environmental gradients within this species. To demonstrate the historical response of G. sannio to extreme climate fluctuations I will generate contemporary and paleo-distribution models to estimate periods of range expansion and contraction. This research will provide the scientific community with a better understanding of the factors shaping contemporary biogeographic patterns while allowing for predictions toward species' response to

future climate fluctuations providing us with the tools to maintain biodiversity in one of the world's most biologically rich regions.

P183 Mating when alone: reproduction of the Titan Acorn Barnacle *Megabalanus coccopoma* in its introduced range

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J. Scott Harrison

Invasive species are a significant conservation concern given their contribution to native species decline. The barnacle, *Megabalanus coccopoma*, is a common invasive species in tropical and subtropical regions of both the Pacific and Atlantic oceans. Little is known about the life history and ecology of *M. coccopoma*, and data on reproductive biology could provide valuable insight into its propensity to establish introduced populations. Most species of barnacle (including *M. coccopoma*) are hermaphroditic, but self-fertilization is rare in species studied to date. A recent genetic study of introduced *M. coccopoma* populations in the southeastern US showed high levels of genetic variation but more homozygosity than expected. One explanation for this pattern is that self-fertilization may be induced when individuals settle where no potential mates are available. The purpose of this study is to test for self-fertilization in *M. coccopoma* using highly variable genetic markers. Larvae were collected from the mantle cavity of mature barnacles that were isolated from any potential mates. Multi-locus genotypes of larvae were compared with maternal genotypes to detect the presence or absence of non-maternal alleles. Preliminary data revealed that the offspring of isolated adults had allelic contributions from more than one parent. These results indicate that isolated barnacles are reproducing, but not by self-fertilization. Other mating mechanisms such as spermcasting may be utilized by isolated *M. coccopoma* individuals.

P184 Is the winter abundance of Red-headed Woodpeckers related to acorn production in a bottomland hardwood forest in northwest Tennessee?

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Red-headed Woodpeckers (*Melanerpes erythrocephalus*) move from open habitats into bottomland hardwood forests during the winter. As part of their winter diet, they collect and cache acorns in crevices and holes found in dead branches. Our long term goal is monitor the abundance of Red-headed Woodpeckers and correlate that with annual acorn production. This poster is a summary of our findings from the first six years of data collection. To census woodpeckers, we established five points located 250 m apart along a trail. Each point was sampled twice a month through the fall and early winter. At each point we conducted 3 min unlimited-radius silent counts. We established nine 50 m X 50 m plots parallel to the trail to identify and mark oaks for annual acorn surveys. We used a visual method consisting of two observers inspecting different parts of the crown and counting the number of acorns observed for 15 sec. These two numbers were added together to get the total number of acorns observed for 30 sec. For analysis, we categorized acorns as either red oak or white oak since they differ in content, which may impact their quality as a food source. For the first four years of data collection, the abundance of woodpeckers was similar, but over the last two years there has been a decline in acorn production and a corresponding decline in woodpecker abundance. We have observed Red-headed Woodpeckers interacting with competing species, possibly protecting their acorn caches. We will continue to document interactions between

Red-headed Woodpeckers and their competitors. These interactions with competitors may also influence the winter abundance of Red-headed Woodpeckers in bottomland hardwood forests.

P185 Assessing deer abundance in Kennesaw Mountain National Battlefield using motion detection cameras

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White-tailed deer (*Odocoileus virginianus*) are an adaptable species that can maintain high-density populations in suburban areas. In landscapes where patches of parkland are embedded in a matrix of suburban development, interactions between humans and deer can have negative outcomes. These include increased frequency of automobile collisions with deer, damage to landscape and horticultural elements, and alteration of the vegetation in the parkland with increased deer browsing. Kennesaw Mountain Battlefield National Park (KEMO), a 992 hectare patch of forest and grassland embedded in the suburban matrix of Cobb County, Georgia is an excellent example of this pattern. To assess deer populations in KEMO, park personnel placed 12 motion detector cameras throughout the park during February 2015. Cameras were baited with corn and set to record activity over a period of two weeks. To use the data from the cameras to estimate abundance requires unique identification of antlered bucks in the photos. Images from two cameras were downloaded and assigned to four independent observers. Each observer was given a written protocol for identification and enumeration of unique bucks based on antler structure and asked to score all bucks in all photos. Initial results indicate that the protocols are effective in produce consistent identifications. Future work will build on these results with the ultimate objective of producing estimates of the KEMO deer population.

P186 Baseline Population Survey of *Gopherus polyphemus* for Management Purposes

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Gopher tortoises (Gopherus polyphemus) are a threatened species in Florida and therefore are a species of concern in Florida state parks. This survey was begun in the summer of 2015 and completed in the fall of 2016 at San Felasco Hammock Preserve State Park. Gopher tortoise burrows were used to determine location and population of gopher tortoises throughout the park. Before this survey the majority of the population was thought to be located in the right-of-way along the powerline corridor. After the survey, it was determined that while the right-of-way had a significant portion of the population, approximately one third of the population is found in that area, there are a significant number of gopher tortoises found in other areas of the park. The overall findings were 1) the population of gopher tortoises is much higher in the park than previously realized and 2) there are three locations within the park that have high gopher tortoise populations.

P187 Interactions between captive Ateles fusciceps rufiventris and the reproductive implications of these behaviors

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Casey Carrell, John Quinn

Understanding reproductive behaviors in zoos is important for gaining holistic knowledge about the health of animals in captivity as well as predicting what variables affect breeding behaviors in the wild. We observed the behaviors of three

captive Colombian black spider monkeys (*Ateles fusciceps rufiventris*) over a period of four months at the Greenville Zoo, Greenville SC. Through our study, we sought cues of reproductive behavior between Mojo, a 16-year-old male, and Jasmine, a 19-year-old female. Laboratory-tested fecal samples of Jasmine's estrous cycle over the four months indicate that she has reproductive potential, yet she has not produced offspring. Our nearly 1,500 behavioral observations between September and December 2016 found that social interactions between Mojo and Jasmine occurred significantly less frequently than interactions between Selma, a 40-year-old matriarch, and Jasmine. Potential reproductive behaviors between Mojo and Jasmine were even less frequent than social interactions between the two (<10 occurrences), and never resulted in copulation. Our results suggest that since Jasmine is fertile and Mojo still does not mate with her, there is an unknown factor influencing the lack of breeding between the two reproductive-aged primates.

P188 An investigation into population structure and gene flow in North American *Castanea* Mill. (Fagaceae)

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M. Taylor Perkins, Joey Shaw, Ashley B. Morris

Recent examinations of North American *Castanea* have primarily focused on building a phylogenetic hypothesis based on non-coding chloroplast sequence data. While this has brought clarity to understanding much of the genetic variation within this genus, questions still remain about biparental inheritance and gene flow within and among species. Hybridization is thought to occur between *C. dentata* and *C. pumila* throughout areas of sympatry in the southern Appalachians as well as between *C. dentata* and *C. ozarkensis* in the western Ozarks. This study will examine the validity of recognizing hybrid taxa in this group, which have collectively been designated as *C. x neglecta*. We will use evolutionarily neutral nuclear and chloroplast microsatellite loci to document recent gene flow within and among *C. dentata*, *C. pumila*, *C. ozarkensis*, and *C. x neglecta*, each collected in isolation and in sympatry. This will also allow us to gain further insight into questions of gene flow and to establish phylogeographic patterns within this taxonomically complex genus.

P189 Introgression in co-occuring *Baptisia arachnifera* and *Baptisia lecontei* assessed by Sequence-Related Amplified Polymorphism (SRAP) markers

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Austin Brenek, Christopher Randle, John Pascarella

The objective of this project was to test the hypothesis of hybridization between two closely related species, *Baptisia lecontei* and the endangered *Baptisia arachnifera*. *Baptisia arachnifera* was cultivated in an ex situ population housed at the Lake Louise Biological Field Station of Valdosta State University in the 1980s in an effort to prevent the species' extinction. However, in 2005, *B. lecontei* was discovered near adult *B. arachnifera* plants of that population, as well as seedlings with characteristics intermediate between the two species. To test the hypothesis of integration, we identified SRAP markers capable of distinguishing the two species. Sources for these samples were taken from the original marked B. arachnifera transplants at the Lake Louise site, as well as mature *B. lecontei* growing at some distance and showing no signs of morphological intermediacy. Markers were generated from plant material collected on silica gel in October 2015 including tissue from putative F1s and seedlings grown from seed collected at that site. PCR reactions were run twice, and only markers generated in both runs were analyzed.

Markers were scored as present/absent. The Dice coefficient was used to estimate genetic distance. Genetic distances were visualized using Principal Coordinates Analysis, and a hybrid index was generated for each individual included in the analysis. Our results will contribute to the understanding of hybridization within the genus *Baptisia*, known for extensive natural hybridization, as well as address potential problems within *ex situ* populations of endangered species.

P190 Current Status of the Herbarium of the Alabama Natural Heritage Section (ALNHS)

Wayne Barger, Natural Heritage Section, ALDCNR, State Lands Division, Montgomery, Alabama, 36130
Chris Taylor

Alabama's plant biodiversity is well documented. However, due to consolidation of herbarium collections, emphasis on molecular analysis, and lack of student/public interest, the number of repositories in the state has decreased. The fundamental mission of this herbarium is to house every plant taxa that occurs in the state and to offer an outlet for plant research. Herbarium holdings, ongoing floral projects and future plans will be presented.

P191 The Preliminary Flora of Chewacla State Park, Lee County, AL

Chris Taylor, Natural Heritage Section, State Lands Division, Department of Conservation and Natural Resources, Montgomery, AL, 36130
Wayne Barger

Formed as a Civilian Conservation Corps camp in 1935, Chewacla State Park is a 282 ha property that was formed in 1939. The park is characterized by Upper Coastal Plain/Fall Line topography with dry oak/hickory uplands, loblolly stands, and bottomland floodplain forests. The property lies within the city limits of Auburn, AL, approximately 177 km southwest of Atlanta, GA and 88 km east of Montgomery, AL. The park is managed by the Alabama Department of Conservation and Natural Resources, State Parks Division as a public recreational resource. A flora of this area was initiated in Fall 2014 and is currently ongoing. Plant collections are being deposited at the Alabama Natural Heritage Section Herbarium (ALNHS), with duplicates being deposited at the Anniston Museum of Natural History Herbarium (AMAL) and Auburn University Herbarium (AUA). This poster will provide an overview of the findings thus far.

P192 Rare Vascular Plants of Geneva County, Alabama

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Geneva County has an area of 1,500 km2 and lies in southeastern Alabama approximately 77 km north of the Gulf of Mexico. Geneva County lies entirely within the Dougherty Plain Level IV EPA Ecoregion of the Southeastern Plains. The vascular flora of the county is currently being surveyed. A total of 650 plant specimens have been collected since August 2016. Fifty-one species (7.85% of the flora) had not been previously collected in Geneva County. Twenty-one species (3.23% of the flora) documented during the study appear on the Alabama Natural Heritage Program's list of rare, threatened, or endangered plants of Alabama. The names of the rare taxa are followed by designations of their status. Each species has a global rank (G) representing its status range-wide, and a state rank (S) representing its status in Alabama. A rank of 1 indicates those species that are considered critically imperiled; those with a rank of 5 are considered secure.

P193 The vascular flora of Autauga County, Alabama

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Autauga County has an area of 1,566 square km and lies in central Alabama approximately 230 km north of the Gulf of Mexico. Autauga County falls within the Southeastern Floodplains and Low Terraces and Transition Hills Level IV EPA Ecoregions with small areas of Blackland Prairie. Previously a total of 724 species in 410 genera from 144 families have been documented from the county (Source: Alabama Plant Atlas). During this study, a total of 312 species have been collected since September 1, 2016. Forty-one species documented in this study represent new county records. In addition, 2 species documented during this study appear on the Alabama Natural Heritage Program's list of rare, threatened, or endangered species for the state. The names of the rare taxa are followed by designations of their status. Each species has a global rank (G) representing its status range-wide, and a state rank (S) representing its status in Alabama. A rank of 1 indicates those species that are considered critically imperiled; those with a rank of 5 are considered secure.

P194 Improvements to the Georgia Southern University Herbarium through the NSF Collections in Support of Biological Research Grant

Jessica Devitt, Georgia Southern University, Department of Biology, Statesboro, GA, 30458
John Schenk

Herbaria are libraries of botanical diversity that catalog plant species' occurrences in the past and present. Like all natural history collections, they serve as the foundation for biological science and science policy. The Georgia Southern University (GSU) Herbarium has grown in sixty years from a single cabinet to approximately 21,127 accessioned specimens, representing 236 plant families, 1,511 genera, and 5,258 species. The regional focus of the collection is the Georgia Coastal Plain, one of the most understudied yet biologically diverse ecosystems in Georgia. Sixty percent of the GSU collection is from Georgia, and about a quarter is from Bulloch County, where GSU is located. The collection includes significant holdings from adjacent and nearby states, especially North Carolina, South Carolina, Arkansas, and Florida. Significant holdings outside the regional focus include England, India, California, and Maryland. The Herbarium has a strong commitment to serve its students, public and private partners, and the biological science community of Georgia and beyond. In addition to the accessioned collection, GAS holds approximately 26,500 unaccessioned specimens from backlogged collections, as well as two orphaned collections. A recent award from the National Science Foundation has permitted us to integrate the unaccessioned material, replace deteriorating folders to archival quality materials, update nomenclature, and better engage students and the public.

P195 Preliminary Checklist of the Vascular Flora of Keith Hills Golf Club, Harnett County, North Carolina

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J. Christopher Havran

Golf courses are ubiquitous features of modern landscapes. Although golf courses are viewed as primarily artificial environments, they may have the potential to be home to a variety of native plants. Keith Hills Golf Club encompasses approximately 2.9 square kilometers of the Campbell University campus and is adjacent to the Cape Fear River in Harnett County, North Carolina. The property includes 27 active

holes, 9 closed holes, and natural areas. We set out to determine what types of vascular plants could be found growing on the golf course property. In August of 2014, we began our survey by collecting any vascular plants we observed growing in the closed holes of Keith Hills. In the spring of 2015, we expanded or our survey to include the rest of the Keith Hills property which encompasses mixed pine hardwood forests and the riparian boundaries of the Cape Fear River. We also incorporated into our survey previously-collected specimens from Keith Hills currently deposited in the Campbell University Herbarium (CAU). As of January 2017, we have cataloged a total of 333 plant specimens. These include specimens from approximately 87 plant families, 179 genera, and 235 species. Using information gathered from the USDA Plant Database, it has been determined that out of the 235 species, roughly 80% are native and 17% have been introduced. As the world continues to modernize, it is important to catalog the biodiversity in urban environments so that steps can be taken to manage them in a way that doesn't compromise their natural integrity.

P196 Results of a Vascular Floristic Survey of the Mebane Wetland Restoration Site in Carroll County, TN

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Michael Schiebout

A plant survey was conducted at the Mebane Wetland Restoration Site in Carroll County, Tennessee from 11 September 2015 - 18 April 2016. This site serves as a wetland mitigation site for Tennessee and was created to reestablish essential wetland habitat destroyed because of land development. The objective of this study was to evaluate plant diversity and wetland status of the species at the site after 2 years of mitigation effort. In addition, species composition of a mitigation area was compared to a reference area. This study documented 82 families, 209 genera, and 346 species including infraspecific taxa from the site. We observed 62% of the plants documented met the criteria to be considered "hydrophytic" . The mitigation area had greater species diversity and more non-native species than the reference area.

P197 Defining Plant Communities and the Vascular Flora of Sampson's Landing, Robeson County, North Carolina

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Lisa Kelly

Floristic inventories aid in understanding the plant diversity of ecological communities. We analyzed data from plant inventories (2010 and 2011) of Sampson's Landing in Robeson County, North Carolina, for floristic composition. Our main objectives were to identify dried pressed plants collected from Sampson's Landing and to integrate this information with our existing database: 1) number of taxa present, 2) number of rare and exotic species, and 3) life history characteristics. We also mapped plant communities via GPS coordinates. The analysis revealed 91 families, 197 genera and 265 species (of which 16 were exotic), and 6 plant communities. The most common growth habit identified was forb (127 species). One species named [Macbridea caroliniana] is listed as a federal Species of Concern and state Endangered species. The large variety of plant communities is likely caused by various elevational and soil differences on the site. This study has already aided the Lumber River Conservancy in the identification of species of concern and noxious weeds on the site. The study will assist in teaching students about the local flora and could aid entities in managing similar sites along the Lumber River.

P198 The Vascular Flora of The Big Soddy Creek Gorge, Hamilton and Sequatchie Counties, TN.

Zach Irick, Austin Peay State University, Center of Excellence for Field Biology, Clarksville, TN, 37040
Joey Shaw

The premise of this study was to document the vascular flora of the Big Soddy Creek Gorge (BSCG), located in Hamilton and Sequatchie Counties, Tennessee. BSCG is a 1040 ha, dissected river gorge on the eastern escarpment of the Cumberland Plateau and it drains into the Ridge and Valley. From May 2014 until April 2016 50 collecting trips were made to upland plateau, gorge slope, and lowland Ridge and Valley habitats. Voucher specimens were collected and entered into UCHT. Results of the survey include 97 families, 277 genera and 488 species. Eight species of conservation concern have been documented, including *Castanea dentata*, *Diamorpha smallii*, *Diervilla lonicera*, *Diervilla rivularis*, *Gelsemium sempervirens*, *Phemeranthus teretifolius*, *Ribes curvatum*, and *Scutellaria montana*. Habitats were qualitatively defined using NatureServe's 2015 classification and the Allegheny-Cumberland Dry Oak Forest and Woodland is the representative system with the most extensive cover area. The South Central-Interior Mesophytic Forest also had an extensive cover area most prevalent on north facing lower gorge slopes of BSCG. Other systems with low cover areas include Cumberland Acid Cliff and Rockhouse, Cumberland Riverscour, Cumberland Sandstone Glades and Barrens, and South-Central Interior Small Stream and Riparian. Forty-five non-native species (10% of the flora) were documented. A species area curve was constructed for this study and eight other similar floras of Cumberland Plateau.

P199 Patterns of Anthocyanin Pigment Formation during Fall Leaf Senescence for Tree Species in the Southern Appalachians

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Howard Neufeld

The production of anthocyanins during fall leaf senescence is a common phenomenon for many temperate deciduous tree species. However, the adaptive advantages remain insufficiently studied. We noticed species that produce anthocyanins do so first on the eastern and exterior portions of the canopy. We hypothesized that anthocyanins are produced in these locations first because the leaves there are exposed to both high light and low temperatures which cause photo-damage. The present study examined intra-canopy patterns of ecophysiology and production of anthocyanins for four tree species: *Acer rubrum*, *Betula nigra*, *Fraxinus americana*, and *Quercus palustris*, all co-occurring in a ~1 ha area on the campus of Appalachian State University. Anthocyanin production, gas exchange, and chlorophyll fluorescence (Fv/Fm) were measured diurnally on eastern- and western-facing leaves from summer through fall senescence. For *Acer rubrum*, eastern- (12.2 ± 1.6 µmol m-2 s-1) and western-facing (10.9 ± 1.0 µmol m-2 s-1) leaves had similar photosynthetic rates at similar light levels (~1450 µmol m-2 s-1) prior to senescence, but by peak color eastern-facing leaves had elevated photosynthetic rates (9.2 ± 0.08 µmol m-2 s-1) compared to western-facing leaves (5.8 ± 2.3 µmol m-2 s-1) at similar light levels in the morning and evening (~1250 µmol m-2 s-1). Stomatal conductance values also varied for eastern- and western-facing leaves (0.15 ± 0.02 vs 0.07 ± 0.01 mmol m-2 s-1) by peak color. Fv/Fm was lower on eastern-facing than western-facing leaves (0.64 ± 0.05 vs 0.76 ± 0.01) on cold mornings, suggesting greater photoinhibition of those leaves. Similar

results were found for the other species, and will be presented at the meeting. Our results support the hypothesis that low temperature-high light conditions stimulate early production of anthocyanins on the eastern and outer portions of the canopies of these tree species.

P200 Modified CTAB Extraction of *Hydatica petiolaris* using PVP/PEG

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Matt Estep

Hydatica petiolaris (*Saxifragaceae, Michaux*), Michaux's Saxifrage is a Southern Appalachian herb that thrives on medium to high-elevated rock outcrops. This endemic member of the Saxifrage family grows on multiple rock types in large populations and is an important member of our local flora. The pre-established resistance of this species to DNA extraction using both TRIzol/sarkosyl and CTAB extraction methods suggested a modified approach is needed for future research. The present study used modified CTAB extraction to include polyethylene glycol (PEG) or polyvinylpyrrolidone (PVP) copolymers to identify DNA extraction methods suitable for *H. petiolaris*. During the summer of 2016, twenty-five *H. petiolaris* individuals were preserved on silica gel and stored at -80. Samples were ground with micropestle and extracted using standard CTAB protocol, CTAB with the addition of PVP, CTAB with the addition of PEG, and CTAB using both PVP and PEG copolymers at concentrations between 1 and 3 %. Consistently low 260/230 ratios and unreliable 260/280 ratios were observed. The ineffectiveness of PVP/PEG suggests the presence of an additional secondary metabolite, besides polyphenols or polysaccharides, which could interfere with extraction. Further research is required to rule out possible contaminants to successfully extract clean DNA from *H. petiolaris*.

P201 Using Vulnerability Curves to Determine Whether Tissue Water Relations Differ Among Fraser Fir Christmas Trees Growing at Different Elevations

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Howard Neufeld

The capacity for Fraser fir (Abies fraseri) grown for Christmas trees to adjust to the effects of climate change could have a profound effect on the industry and economy of North Carolina, since this species brings in ~$100 M each year in revenue. This project uses elevation as a surrogate for warming to determine differences in the functioning of the xylem of trees from farms at low (664 m) and high elevations (1228 m) in the North Carolina mountains. I hypothesized that Fraser fir growing at low elevation would increase their hydraulic conductivity (Kh) and have a lower vulnerability to cavitation then trees from high elevation. A higher Kh (the ease with which water moves through the xylem per unit pressure) would enhance the ability to move water to the needles during times of water stress and a lower vulnerability would allow water transport during times of drought. To assess this, we constructed vulnerability curves (VC) for trees from low and high elevation. A VC assesses the sensitivity of the xylem to water stress by measuring the loss in Kh as water stress increases. Initial Kh measurements were made on 2-3 year old branches at a hydraulic pressure of ~0.09 MPa using a Sperry conductivity apparatus equipped with an air-injection sleeve to induce embolisms. Cavitation from air-seeding reduces water flow at a given hydraulic pressure because of the development of embolisms and hence lowers Kh also. The point at which Kh is reduced by 50% (Kh50) was determined for all twigs measured. Analyses of the vulnerability curves did not find any statistical differences in Kh among trees from low and high

elevations or in their vulnerability to cavitation, suggesting that in this species, adjustment to low elevation conditions probably occurs by other means.

P202 Nuclear magnetic resonance reveals significant metabolite difference between wild type and cultivated watermelon roots

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Mihail Kantor

There is significant genetic variation between cultivated watermelon and the wild watermelon. This study is focused on exploring watermelon diversity by analyzing the complete metabolic profile of the cultivated watermelon and comparing it to the wild watermelon. Nuclear magnetic resonance-based profiling was used for metabolite identification. The roots of several wild type watermelons and one cultivar were selected. Different statistical tools were used to highlight the significant metabolite changes between the wild type watermelons and the cultivars. The significantly changing metabolites have been identified using multivariate loading plots. They were found in higher quantities in the wild watermelon (Asparagine, Valine, L-Glutamine, O-phsphocholine, Isoleucine, Arginine, Glutamate, Ethanolamine and Choline). Results also revealed the presence of some metabolites unique to the wild watermelon.

P203 Do American lobsters spill lactate across their gill epithelium during periods of increased metabolic demand?

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American lobsters and other crustaceans carry out anaerobic respiration during periods of increased metabolic demand, producing lactate as an anaerobic end-product. Previous work in our laboratory has demonstrated that lactate can be detected in exhalent ventilatory water suggesting that these animals spill lactate present in their hemolymph across the gill epithelium. We are interested in characterizing the relationship between lactate appearance in the hemolymph and its appearance in ventilatory water. We measured hemolymph and ventilatory water lactate levels in resting and active lobsters. Our data indicate a close, temporal relationship between the lactate levels in the hemolymph and lactate appearance in the ventilatory water. Additionally, our data show that these animals make lactate even at relatively low activity levels.

P204 Verifying the integration of gene construct in transgenic *Catharanthus roseus* hairy root lines for the production of pharmaceuticals

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The *Catharanthus roseus* plant (Madagascar periwinkle) is the source of the valuable anticancer compounds terpenoid indole alkaloids (TIA), vincristine and vinblastine. Due to their complex structure and complex biosynthetic pathway, commercial scale organic synthesis and use of other host organisms are not successful. Therefore, inducing production of these TIA's by manipulating the pathway is highly desired. In previous studies conducted in our group, TIA biosynthesis was manipulated by silencing the repressor gene *Zct1* (zinc finger 1). When inactivated with a RNA-silencing hairpin, lowered Zct1 was not sufficient to increase TIA production, displaying the tight regulatory control by other activators and repressors on TIA biosynthetic pathway. To further understand the role of *Zct1*, the gene will be overexpressed and effects observed. Transgenic hairy root

cultures were developed via *Agrobacterium*-mediated integration of the transcription factor *Zct1*, produced when the gene system is activated. As a control line, the inducible overexpression of Gfp was created. Before conducting biosynthetic studies, the integration of the inducible gene construct into the host genome was verified. The genes used for verification of successful integration are 1) the housekeeping *Rps9* gene, 2) the hygromyosin resistant *HygR* gene, 3) the *Agrobacterium* gene *VirD*, 4) hairy root producing *RolC* gene, and 5) the *LexA* promoter fused to either gene of interest *Zct1Ox* or *GfpOx*. Through genomic DNA extraction, PCR amplification, and visualization on agarose gel, the presence of all desired genes *Rps9, HygR, RolC*, and *LexA* promoter was confirmed, lending the harry root lines suitable for subsequent studies on the role of transcription factor *Zct1* in the TIA biosynthetic pathway of *C. roseus*.

P205 Visual contact with a male limits parthenogenesis in female Egyptian Pygmy Mantids (*Miomantis paykullii*).

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Parthenogenesis is, overall, a rare phenomenon among animal lineages. In species with facultative parthenogenesis, females have the option to reproduce sexually and asexually. Given the low evolutionary potential of asexual reproduction, it is important to understand the factors that drive this reproductive decision. This study examines the role of visual cues in female choice in the Egyptian Pygmy Mantid (*Miomantis paykullii*). Females were separated into two groups: those with visual contact with a male and those who were reared in isolation. Females who had visual contact with a male could see, but not interact and not mate with him. Over the course of the study, the only females that laid ootheca were those that had no visual contact with males. Two females produced three ootheca from the non-visual cue group. Females in visual contact with males exhibited no reproduction until 24 days after the death of the male and subsequent isolation. Though there is little information about the population density of this species in the wild, facultative parthenogenesis may be an adaptation to variability in access to males.

P206 Examining the Role of Blood Vessels in Neural Progenitor Cell Migration

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Stem cells in adult organs appear to reside in specialized niches that regulate their proliferation and differentiation (1). Recently, a regulatory role for blood vessels in these micro environments has been suggested as a mechanism to regulate neurogenesis (the birth of new neurons) (2). In the adult mammalian brain, neural stem cells are located close to the vasculature in each of the two neurogenic regions observed in all mammals. In recent studies, postnatal neurogenesis has been reported in several regions of the fish brain including the olfactory bulb, dorsal zones of the telencephalon, hypothalamus, and divisions of the cerebellum (3,4). While fish brain is reported to contain more neurogenic regions than the mammalian brain, little else is known about neurogenesis in the adult fish brain. An understanding of the proximity of neural stem cells to blood vessels and their ability to respond to factors circulating in response to environmental changes would advance our understanding of how neurogenesis is regulated. We further propose neural stem cells migrate along blood vessels as they migrate away from proliferative zones. Using thymidine analog incorporation assays (5), we examined the proximity of neural stem cells to blood vessels. We are currently quantifying the number of cells associated with blood vessels. The findings obtained in this study will advance our understanding of the role of blood vessels and neural stem cell

migration and will also contribute to future studies examining factors that may alter neurogenesis.

P207 The Effects of Cigarette Smoke and Electric Cigarette Vapor on Prenatal *Drosophila melanogaster*

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In humans, nicotine exposure during pregnancy affects pre and postnatal growth, increases risk of miscarriages, increases morbidity, and affects cognitive development. Using *Drosophila melanogaster* as a model, we compared the ill effects of nicotine delivered by standard cigarette smoke verses electric cigarette vapor. D. melanogaster males were placed into separate vials which were injected with either 50-ml of cigarette smoke containing .5 mg of nicotine, 50-ml of electric cigarette vapor containing .5 mg of nicotine, or 50-ml of water vapor (control). The treated males were then transferred into vials containing females to encourage mating. It was noted that after 80 minutes, the cigarette smoke had a narcotizing effect on the males. These males remained comatose for at least 24 hours before complete revival with no noticeable ill effects. There was a distinct higher mortality in male flies exposed to electric cigarette vapor. There appeared to be no difference in the mortality between the flies affected by cigarette smoke and the flies exposed to the water vapor control. When compared to the water vapor control, we found that considerably more eggs were laid by flies exposed to cigarette smoke, while there was a definite reduction in eggs laid in the electric cigarette environment. Other data that will be compared in this study include days to adult emergence, body length, total development time, sex ratio, and wing, body, and eye defects.

P208 The Effect of Progesterone on the Endogenous Production of Nitric Oxide & Tumor Necrosis Factor in RAW 264.7 Cells

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It has been widely established that, in addition to its role in reproduction, progesterone (P4) also has potent anti-inflammatory effects. While the precise mechanisms have never been clearly elucidated in RAW 246.7 cells, it seems logical to assume that this response is - at least in part - a consequence of activation of and signaling through the progesterone receptor (P4-R). However, it has recently been shown that in a rat model, this anti-inflammatory effect is - in fact - independent of the progesterone receptor. In this project, the aim was to characterize this response by assaying nitric oxide production from lipopolysaccharide-challenged RAW 264.7 cells and ascertain the involvement of the P4-R. To determine the contribution of the receptor, RAW cells were incubated in the presence and absence of RU-486 - a potent P4-R antagonist. Our results indicate that the anti-inflammatory response of progesterone was in fact through the activation of the P4-R as cells incubated in RU-486 show an approximate 60% reversal of the inhibitory effect of P4 as compared to cells incubated in the absence of the antagonist. However, because we did not observe a complete reversal, suggests that perhaps other receptors come into play which will be addressed in future studies.

P209 Effects of aromatherapy using essential oils on circulating cortisol levels

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Although essential oils have been used since ancient times, modern scientists have provided relatively few empirical studies that establish a clear relationship between essential oil and changes in behavior. The previous literature has primarily focused on memory and mood. Moss et al., (2002) found that exposure to lavender oil impaired memory, but increased mood. Perhaps, the mechanism for this effect is that the oils caused relaxation and therefore, reduced stress and improved mood. The present study was conducted to test the hypothesis that some essential oils reduce perceived stress levels and this would correlate with a reduction in cortisol. A within-subjects design was utilized. Participants were randomly assigned to either a control condition where only filtered water was dispersed into the room by a small diffuser (n=12), or to the experimental condition where the diffuser dispersed the recommended dosage of six drops of oil into the room (n=12). After participants completed an informed consent form, they were given a questionnaire assessing current stress levels and gave a sample of saliva. Then they were asked to spend about 30 minutes engaged in a filler task (coloring). Finally, participants complete the post-test stress questionnaire and provided another saliva sample. Statistical analysis revealed that there was not a significant difference between the control group and the experimental group in free circulating cortisol ($p>.05$). However, there was a difference between these two groups in their self-reported levels of stress ($p=.029$). The experimental group reported feeling calmer and less stressed at the conclusion of the experiment. Further studies are needed to elucidate the physiological underpinning for these d.ifferences in perceived stress levels.

P210 Electrical Stimulation of Gustatory Cortex Causes the Activation of Motor Neurons in Conscious Rats

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The role of the gustatory cortex (GC), a forebrain region that receives taste and other orosensory input, in the control of taste-related behaviors is unclear. The goal of the present study was to determine if electrical stimulation of the GC, that elicits taste reactivity (TR) behaviors, causes perception of a taste or activates a motor output. Conditioned taste aversion (CTA) was used as a way to measure possible taste perception. Under sodium pentobarbital anesthesia, an electrode was placed into the GC using a stereotaxic device and intraoral cannulas were implanted into seven male Wistar rats. Following a week of recovery, rats received an i.p. injection of either LiCl (experimental group) or NaCl (controls) followed by electrical stimulation of the GC and intraoral infusion of taste solutions. A two-bottle preference test comparing water and sucrose intake also was performed. Immunohistochemistry for the Fos protein was used to identify neurons activated within the GC. During electrical stimulation, the number of aversive taste reactivity (TR) behaviors expressed by experimental rats (n=4) increased over time as compared to control rats (n=3; $p<0.05$). TR behaviors in response to intraoral solutions were not different between treatment groups, however, HCl elicited the most aversive responses and sucrose elicited the most ingestive responses among all animals regardless of treatment group. The two-bottle preference test showed that both groups preferred sucrose over water. The center of the electrode tract typically was located within the GC 1.0-1.3 mm anterior to bregma with some variation among animals. Specifically, the Fos protein was expressed in neurons that mainly were spread throughout the granular and dysgranular insular GC. These data indicate that electrical stimulation of the GC did not result in the perception of a taste and that the observed TR behaviors were most likely attributed to stimulation of a motor output.

P211 Cardiac Dynamics in the American Lobster Under Varying Conditions of Metabolic Demand

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Lobsters move hemolymph through their circulatory system by the action of a single-chambered heart (ventricle) that contracts rhythmically. The ventricle is suspended in the pericardial sinus, a space in which hemolymph that has passed through the gill chamber collects. Hemolymph enters the ventricle, from the pericardial sinus, through valved slits (ostia) in its wall during the time period between contractions. Following the filling phase of the cardiac cycle, contraction of the ventricle closes the ostial valves and ejects hemolymph into the arterial network vessels. We are interested in characterizing the dynamics of ventricular filling and hemolymph ejection from the ventricle during contraction. We measured, concurrently, pulsatile hydrostatic pressure in the ventricular lumen and the pericardial sinus, and hemolymph velocity in the dorsal abdominal artery just downstream from its juncture with the ventricle. Heart rate was determined from the pulsatile pressure data. Ventricular and pericardial sinus pressures were overlaid electronically so that the continuous difference between the pressures could be determined. This difference was quantified as the cardiac filling index (CFI). These parameters were monitored in tethered animals at rest and as they walked on a submerged treadmill therefore experiencing increased periods of oxygen demand. We found that the CFI decreased during the exercise period concurrent with increased heart rate. Arterial hemolymph velocity was observed to be quite dynamic. Our data also suggest that the hydrostatic pressure in the pericardial sinus is not homogeneous and this has implications regarding the filling dynamics, as the ostia are distributed circumferentially around the ventricle.

P212 Frequency of Aerial Respiration by Juvenile Pterygoplichthys disjunctivus (Loricariidae) in Hypoxic Conditions

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Volusia Blue Spring, a hypoxic freshwater spring, has been home to the invasive armored catfish *Pterygoplichthys disjunctivus* (Loricariidae) since 1999. All fish living in such an environment must make behavioral and physiological modifications to survive without significant amounts of dissolved oxygen. Air-breathing behavior in adult armored catfish has been described, however the juveniles of this species are rarely found in the spring run. This observed absence of juveniles led us to investigate their behavior in hypoxic conditions, and to pose the hypothesis that smaller juvenile fish would be more sensitive to lower oxygen levels than would larger juvenile fish, and that this difference would be reflected in different rates of air-breathing. Air breathing behavior was measured (breaths/hour) in 12 small (5-7.9 cm) and 24 large (8-13 cm) juvenile armored catfish housed in a range of dissolved oxygen. We also measured the surface area of the air-breathing organ (the stomach). Our results showed that smaller juveniles rely on aerial respiration significantly more than do larger juveniles in hypoxic conditions (below 2-3 mg O2/L). Stomach surface area was negatively correlated with fish standard length.

P213 Neuroprotective Effects of Nicotine and Neuromelanin in Dopamine Neurons

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Nicotine is notorious for its harmful role in cancer and cardiovascular disease. However, clinical trials are currently underway to examine the therapeutic utility of nicotine in managing cognitive disorders associated with Attention Deficit Hyperactivity Disorder and movement disorders associated with Parkinson's disease. Intriguingly, epidemiological data provides evidence to suggest that smokers are less vulnerable to Parkinson's disease compared to non-smokers. Similarly at the cellular level, it has been shown that nicotine has neuroprotective effects in minimizing the damage from chemical toxins and preventing neuronal death in animal models of Parkinson's. The mechanisms by which nicotine is neuroprotective is unknown. Previous research has shown that both ADHD and Parkinson's disease involve the depletion of dopamine, which can be regulated by nicotine. The goal of this study is to investigate the cellular mechanisms that underlie the neuroprotective effects of nicotine. The pigment neuromelanin is present in dopamine neurons, plays a role in sequestering iron and quite possibly dopamine, and has also been shown to interact with nicotine. Thus, our working hypothesis is that nicotine's neuroprotective effect may be tightly linked to its interaction with neuromelanin in dopaminergic neurons. Specifically, we hypothesize that nicotine will be more protective in pigmented cells vs non-pigmented cells. To test this hypothesis, rat substantia nigra neurons were pretreated with smoking-relevant nicotine doses in culture and then exposed to neurotoxic doses of MPTP (1-methyl-4-phenyl-1,2,3,6-tetrahydropyridine) to induce pigmentation. The correlation of glial fibrillary acidic protein and tyrosine hydroxylase immunoreactivity revealed the incidence of neurotoxicity in dopamine neurons. Here, we present our preliminary findings and future experiments to understand the relationship between neuromelanin and nicotine in dopamine neurons.

P214 Histone-Mediated cytochrome C release from Mitochondria: a process conserved across Eukarya?

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Cytochrome C release from mitochondria is correlated with, though not necessarily induces, programmed cell death mechanisms in a wide range of eukaryotes, and in vertebrates it induces apoptosis. Cascone, et al (2012, PLOS One 7: e35357) showed in mammalian liver cells that each of the core histones and H1 bound to mitochondria and elicited cytochrome C release. Preliminary studies using cauliflower (Major, M.S thesis, JSU) showed that exogenous H3 bound to mitochondria in a saturable manner and that histone-enriched fractions induced cytochrome C release. We hypothesize that histone binding to mitochondria and subsequent cytochrome c release is broadly conserved across Eukarya and provides a mechanism linking DNA or nuclear damage to cell death processes. We are investigating histone-mitochondrial interactions in cauliflower in more detail, and performing preliminary investigations in brewer's yeast as well. We have developed procedures to obtain gram quantities of yeast or cauliflower protoplasts to enable cell fractionation and partial purification of large quantities of histones. Histone fractions will be incubated with purified mitochondria and histone binding and cytochrome C release will be assessed by immunoblotting against cytochrome C, H3 and at least one other histone antibody. Cross-incubation experiments between yeast and cauliflower histones and mitochondria will be performed as well to assess the conservation of this interaction across divergent organisms. These investigations can be further enhanced by using other organisms such as *Tetrahymena* and *Chlamydomonas* and by HPLC purification of individual histones in order to better understand how conserved this mechanism is.

P215 The *Drosophila* translational regulator Pumilio controls nociceptive neuron sensitivity.

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The *pumilio* gene encodes a member of the evolutionarily conserved Puf-family of RNA-binding proteins. Pumilio functions in *Drosophila melanogaster* during embryonic development and in mature neurons by downregulating the translation of many different mRNA transcripts, including some proteins which are implicated in the detection of noxious stimuli, or nociception. Building on these known functions of Pumilio in *Drosophila*, we hypothesize that it is a regulator of sensory neuron function. We have used the GAL4/UAS system and RNA interference to drive the knockdown of *pumilio* RNA in nociceptor neurons, and then tested the resulting larvae using mechanical and thermal nociception assays to detect changes in sensory neuron function. By comparing the responses of these offspring to a positive and negative control, we have found that removing the function of Pumilio increased nociceptor sensitivity. These results suggest that Pumilio normally negatively regulates the function of *Drosophila* nociceptor neurons, but the mechanisms of this role are not known. We have also begun to measure the levels of mRNA transcripts that have already been implicated as important for nociception. Quantifying the changes in these transcripts in the presence and absence of *pumilio* will provide strong evidence about some of the targets of the *pumilio* pathway. Because the Pumilio protein is present in all metazoans we hope that these results will provide insight into the mechanisms of nociceptor function in humans.

P216 Evidence Supports Claims the Histone H3 is Present in Mitochondria of Diverse Species

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Previous research indicates that Histone H3 is found in mitochondria as well as in nuclei of *Brassica oleracea* cv. Botrytis (cauliflower). We now have evidence that the same is true in *Drosophila melanogaster* (fruitfly), *Bos taurus* (cows), and Jurkat cells (a human cancer cell line). The presence of H3 in mitochondria thus appears to be conserved through the evolution of multi-celled eukaryotes. Such conservation usually indicates that the conserved process is necessary to sustain life. One intriguing possibility is that the histone proteins localize to mitochondria as a part of a stress response and/or to initiate apoptosis. Although some published reports support the hypothesis that H3 localizes in mitochondria as a part of a programmed cellular response, many in the scientific community remain skeptical about the validity of those reports and of the presence of H3 in the mitochondria. To address this skepticism, we designed additional controls to eliminate the possibility that nuclear DNA, known to bind non-specifically to the surface of mitochondria in cell homogenates, is responsible for the presence of Histone H3 in mitochondrial preparations.

P217 The Roles of Gαq and PLC in Regulating Mechanosensory and Thermosensory Behavior in *Drosophila melanogaster*

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Nociception is the ability of sensory neurons to detect thermal, mechanical, or chemical stimuli that can be harmful to an organism and generate a behavioral response. This is a process that has been conserved throughout vertebrate and invertebrate systems including the fruit fly, *Drosophila melanogaster.* G proteins are known to regulate sensory neuron function in many systems, but no specific role has been identified in Drosophila nociception. Gaq is a Ga subunit of the heterotrimeric G protein complexes that activates Phospholipase C (PLC), an enzyme responsible for the generation of the signaling molecules, IP3 and DAG. These enzymes are known to regulate the function of many different types of neurons, suggesting that they might have a role in controlling the function of Drosophila nociceptors. Transgenic flies with altered Gaq and PLC signaling were stimulated with thermal and mechanical stimuli and behavioral responses were used to determine sensory neuron function. Gene function of Gaq and PLC were reduced in transgenic flies using RNA interference, which resulted in a reduced behavioral response to a thermal and mechanical stimulus. PLC and Gaq were overexpressed with genetic manipulations that increased the protein level or enzymatic activity of the proteins, which generally yielded an increased response to thermal and mechanical stimuli. These results suggest that Gaq and PLC positively regulate the function of Drosophila sensory neurons and that this signaling pathway is important for thermal and mechanical nociception. These experiments identify the roles of PLC and Gaq as necessary for normal nociception and provide a foundation for future experiments that will identify the cellular/molecular mechanisms of how these enzymes function in Drosophila nociceptor neurons.

P218 Identification and validation of *Saccharomyces cerevisiae* genes required for growth in an environment lacking sulfur

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Saccharomyces cerevisiae is a model eukaryotic organism whose genome has been sequenced and widely studied. To discover the genes in *S. cerevisiae* required for viability when cells are starved for sulfur, a growth assay was performed on a knockout library containing 5,132 strains of *S. cerevisiae*, each with a specific and different gene removed, with either synthetic complete medium or medium lacking sulfur. Cell concentrations were determined by spectrophotometric analysis to measure the growth of each strain after four hours of growth in each environment. Strains that displayed poor growth in sulfur deficient conditions were determined after analysis by two methods: a) background subtraction followed by quantile normalization and comparison to growth in control conditions, and b) cellHTS2, which is based on interquartile range and combines both normalization and comparison between media. Genes found to be in the top five percent of either analysis were retested to validate their necessity in sulfur metabolism. The cellular roles and interconnection of genes of interest confirmed during this validation will be discussed. Here we identify genes required for sulfur metabolism and genes required for nutrient stress response, which have implications for orthologous genes in other species.

P219 Biochemical characterization of alpha-synuclein protein aggregates in *Saccharomyces cerevisiae*

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Parkinson's disease (PD) is a neurological disorder affecting the dopaminergic neurons in the brain that can cause tremors, slow or delayed reactions and a lack of coordination. One characteristic of PD is the loss of function of the dopaminergic

neurons potentially caused by an accumulation of the protein alpha-synuclein. Alpha-synuclein, a 140-amino acid protein, has been shown to form aggregates in the dopaminergic neurons as seen in post-mortem brains from PD patients. How these aggregates form and how the aggregates actually contribute to the loss of function of the neurons is largely unclear. This research uses the budding yeast, Saccharomyces cerevisiae to model PD at the biochemical level. This research aims to understand the composition of these protein aggregates using mass spectrometry as well as the role that ubiquitination may play in alpha-synuclein degradation of alpha-synuclein in the yeast model. Purified alpha-synuclein containing protein aggregates from PD model yeast were subjected to mass spectrometry analysis. The results indicated the presence of the metabolic proteins pyruvate kinase and pyruvate decarboxylases as components of the alpha-synuclein containing aggregates. Further studies with the PD model yeast revealed that inhibition of deubiquitinating enzymes (with a chemical inhibitor) in vivo led to a reduction in the amount of alpha-synuclein present in PD model yeast. Overall, these results suggest that metabolic proteins play a role in alpha-synuclein protein aggregation, and that DUBs also facilitate aggregate formation through the removal of ubiquitin from alpha-synuclein in our PD model yeast.

P220 Modulation of Hsp70-Mediated cytoprotection by Resveratrol and Staurosporine in Colon Cancer Cells

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Colon cancer is a predominant cancer among African American (AA) men as compared to Caucasian men with a higher death rate in AA from the disease. Preventing the progression and metastasis of colon cancer by targeting molecules that contribute to cell survival and proliferation presents a suitable chemotherapeutic approach of the disease. In colon cancer, overexpression of heat shock protein (Hsp70) encourages the progression and metastasis of the disease. Over expression of Hsp70 involves anti-apoptotic roles and induce the growth of colon cancer. Therefore, Hsp70 has emerged as drug targets for colon cancer therapy. Our studies aimed at looking at the chemotherapeutic effects of naturally occurring molecules resveratrol (RES) and staurosporine (STS) on the expression of Hsp70, which are potent cytotoxic drugs. We hypothesize that the use of natural compounds will block the Hsp70-mediated protection in colon cancer. To accomplish this, HCT116 WT and SW480 colon cancer cells were treated individually with RES (100μM) and STS (1μM), for 24h, and cell killing, morphology, mitochondrial potential ($\Delta\psi m$), and expression of Hsp70 was studied. Our preliminary results indicated that RES and STS treated cells showed altered cell morphology and enhanced cell killing. Further, results demonstrated that the expression of Hsp70 decreased in treated HCT116 WT and SW480 cells. Thus, these findings illustrate the importance of these agents as potential therapeutic molecules in controlling colon cancer.

P221 An estimate of the mitochondrial DNA mutation rate in Rett-syndrome-model mice carrying the *MECP2* gene

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Rett Syndrome is an X-linked neurodegenerative disease. This disease is the result of the X-linked MECP2 gene, and is fatal before reproductive age in the hemizygous

males and homozygous females. The MECP2 gene product is an active transcriptional repressor that dampens transcriptional noise. The loss of MECP2 negatively affects the preferential binding of protein, MeCP2, and reduces DNA stability. This allows widely uncontrolled transcription across the entire genome. We hypothesized that the progressive effects in the Rett mouse model originate from mitochondrial mutations and could be specifically evaluated through the observation of mitochondrial mutations and heteroplasmy. DNA extraction, amplification, and sequencing techniques were used to observe the mitochondrial DNA sequence of two wild type (WT) and two Rett-model mice (MT). We found that the mitochondrial DNA in the highly variable D-Loop region of the MT mice had the exact same sequence as that of the WT mice. We also did not observe heteroplasmy in either strain. This suggests that the progressive nature of Rett Syndrome is not due to mitochondrial mutations nor deviations from the standard sequence. We believe efforts should be focused on next-generation sequencing to confirm these results and new research should be conducted on the nuclear DNA in both of these samples.

P222 Interactions of Butyric Acid (BA) with Aryl Hydrocarbon Receptor (AHR) Active Microbiota Metabolites

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The aryl hydrocarbon receptor (AhR) is a transcription factor that is activated by both exogenous and endogenous ligands. The activation of AhR by these ligands induces the expression of different downstream genes such as cytochrome P450 family 1 subfamily A member 1 (CYP1A1) and cytochrome P450 family 1 subfamily B member 1 (CYP1B1). AhR plays a major role in the regulation of inflammation, immune disease and tumor growth. The most potent exogenous compound that activates AhR is 2,3,7,8-tetrachlorodibenzo-p-dioxin (TCDD), which is an environmental toxicant, and belongs to the family of halogenated aromatic compounds. This project is part of an extensive study focused on studying the AhR agonist and antagonist activities of microbiota metabolites and their functions in gut health. Butyric acid (BA) is a short-chain fatty acid which is synthesized by bacteria in the gut from foods rich in fiber and starch. BA promotes gut health and plays a vital role in the regulation of anti-inflammation, immunoregulation, apoptosis and colonocyte proliferation, and this may be due in part to the activities of BA as a histone deacetylase (HDAC) inhibitor. In this study, we investigated the interaction of butyric acid with AhR active tryptophan metabolites in young adult mouse cells (YAMC) and human CaCo2 cancer cells using CYP1A1 as marker gene. We observed that BA enhances CYP1A1 expression induced by AhR active compounds and the underlying mechanisms are currently under study.

P223 The Effects of E-cigarette Exposure on Cell Viability and Gene Expression

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Marketed as a smarter alternative to tobacco cigarettes, electronic cigarettes have risen in popularity among consumers. However, concern regarding possible health consequences from their use has also increased, and though marketing campaigns would say otherwise, scientific research has not yet validated the common assumption that e-cigarettes are a safer option to tobacco cigarettes. Studies have shown the presence of toxic and carcinogenic compounds to be within filler solutions of e-cigarettes, as well as the tobacco alkaloids anabasine, cotinine,

myosmine, and nicotine. These four tobacco alkaloids were tested within this study for their in vitro effects on cell proliferation and gene expression using a panel of lung cell cultures distinguished by differences in sex and disease status. We hypothesize that exposure of lung cells to tobacco alkaloids is associated with abnormal proliferation and expression of genes, leading to abnormal cellular function and end symptoms that are recognized as disease. We predict that the cellular responses to tobacco alkaloids will present in a sex-specific manner that may shed light on how men and women respond differently to environmental exposures. Alkaloid exposure of each cell line was evaluated at three different concentrations (1, 10 and 100 µg/mL) in a 10-day time course. Cellular proliferation was recorded daily using the Cell-Titer Glo luminescent viability assay, and RNA was isolated after 48 and 96 hours of alkaloid exposure for gene expression analysis of cancer biomarkers by qRT-PCR. Preliminary findings indicate that some tobacco alkaloids, namely anabasine and cotinine, have a stimulatory effect on cell growth. Other alkaloids, specifically myosmine and nicotine, display an inhibitory effect. Differences in exposure response and proliferation profiles were observed among the tested lung cell lines. Notably, the cancer cell line demonstrated a greater degree of variability among replicates, which we attribute to the non-clonal nature of this cell population.

P224 Analysis of local population of *Wolbachia* strains

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Our goal is to identify local strains of *Wolbachia* found in insects collected near the Armstrong campus. *Wolbachia* is a parasitic endosymbiont that resides in the reproductive cells of insects and other arthropods. In insects, *Wolbachia* manipulates reproduction to increase the number of infected females through four methods: feminization, male killing, cytoplasmic incompatibility, and parthenogenesis. The samples used in the experiment were selected from an archive of purified DNA generated by introductory biology students. The samples were extracted from insects collected in the local Savannah population and were subsequently confirmed to contain *Wolbachia's* *16s rRNA* gene via PCR. The purpose of this experiment is to increase our knowledge of the biodiversity of *Wolbachia* in our local population of insects. This information may be important in future efforts to control pest insect populations. To identify the different strains of *Wolbachia* previously collected, we amplified the relatively highly variable *wsp* (*Wolbachia* Surface Protein) gene. Amplified samples were confirmed by gel electrophoresis and will be sequenced in the future. The resulting *wsp* sequences will be used to identify the *Wolbachia* strains in the local insect populations.

P225 A Study of E. coli in Lake Martin, Alabama

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Escherichia coli, also known as *E. coli*, can be hazardous to humans. *E. coli* is also a determinant of water quality. I conducted a study by collecting over 100 water samples in Lake Martian, located east of Montgomery, Al. The samples collected showed that the *E. coli* counts averaged zero. The few *E. coli* that were collected were analyzed for their source of origin.

P226 The use of bacteriophage in preventing bacterial infection of *Caenorhabditis elegans* by *Bacillus thuringiensis kurstaki*

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According to the CDC, 2 million people in the United States alone become infected with antibiotic resistant bacteria every year. At least 23,000 of them die due to these infections with many more deaths associated with complications. Bacteriophages are currently being studied as an alternative to antibiotics. This study will evaluate the efficacy of using a bacteriophage called Archie14 to target *Bacillus thuringiensis kuristaki* (Btk) after being ingested by *Caenorhabditis elegans*. Btk causes reproductive issues and death in *C. elegans* within 36 hours of ingestion and Archie14 has been shown to lyse Btk *in vitro*. The ingestion of the bacteriophage should cause the lysis of Btk within *C. elegans*, allowing the nematodes to survive and reproduce. As populations of *C. elegans* grow, so do the concentrations of CO2 that they produce. The concentration of CO2 produced by the control groups and the experimental group will be recorded using a Vernier CO2-BTA CO2 Gas Sensor. Comparing the concentrations of CO2 produced by each group should indicate if the bacteriophage was able to protect the *C. elegans* populations from the negative effects of Btk infection. The nematodes that were exposed to the bacteriophage will then undergo a plaque analysis to verify that the bacteriophage was ingested and working from within the C. elegans.

P227 Exploring The Potential Of Trehalose As Anti-Radiation Agent on Tetrahymena

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Robert Austin, Melba Horton

Trehalose, a disaccharide thought to be responsible for the protection of DNA from ionizing radiation, could enhance the radiation damage resistance of living organisms in deep space exploration, as well as other industrial applications. This study aims to explore the anti-radiation effect of trehalose on a simple eukaryotic protozoan, *Tetrahymena* which is a model organism commonly used in biomedical research. Cells of *Tetrahymena* were obtained commercially and cultured in petri dishes under controlled laboratory conditions devoid of any light exposure. Five individual cells were distributed in each of the 25 petri dishes containing wheat medium. Varying concentrations of trehalose at 0.25, 0.5, 0.75, and 1.0 mg/mL were added to the dishes in the experimental set-up while the rest only contained wheat medium as control in five replicates. Changes in cellular morphology and behavior of Tetrahymena such as; swimming pattern and speed, membrane property, and vacuole size were monitored daily by destructive sampling. Observations of the different response parameters were carried out using a differential interference contrast (DIC) microscope with camera attachment. New batches of cells were cultured under exactly the same conditions but this time the petri dishes were subjected to UV radiation for varying exposure periods of 3, 6, 9, 12, and 24 hours in a biosafety cabinet. Comparison of the cell responses with and without UV exposure will be discussed and the implications of the results for future endeavors will be expounded.

P228 JAK2 may be the pathway responsible for immunoproteasome activation in the presence of TNF-a

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Immunoproteasomes play a pivotal role in the adaptive immune response through the degradation of endogenous antigens into peptides. The freshly cut peptides can then be loaded onto MHC I and delivered to the cellular surface, presenting an opportunity for subsequent interaction with a CD8+ T-cell. Our lab is interested in determining how immunoproteasomes are activated in the presence of various cytokines. We have previously shown that Janus kinase 2 (JAK2) is a protein tyrosine kinase which is responsible for activation of the immunoproteasome in the presence of IFN-ï §. We hypothesize that JAK2 also plays a role in the formation of an immunoproteasome in the presence of TNF-a; hence, blocking the JAK2 pathway in the presence of TNF-a should lead to a decrease in immunoproteasome subunit expression. To test the theory, siRNA inhibition of the JAK2 pathway was carried out in JAWSII Dendritic Cells, followed by TNF-a treatment and Western Blot analysis. These experiments will give us more insight into immune activation, and could potentially lead to better treatments against infectious intracellular agents.

P229 The Potential Role of Niche Occupancy on the Production of Toxigenic Exoproteins by Virulent *Aeromonas hydrophila*

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In 2009, a highly virulent strain of the ubiquitous aquatic bacterium, *Aeromonas hydrophila*, was isolated from a diseased channel catfish within a production pond in West Alabama. This hypervirulent strain, referred to as virulent *Aeromonas hydrophila* (v*Ah*), has been responsible for epidemic outbreaks of peracute motile Aeramonad septicemia (MAS) in Alabama catfish production ponds. To date, v*Ah* has been responsible for the loss of over 15 million pounds of marketable channel catfish from production farms in West Alabama, and the bacterium continues to cause significant losses in the Southeastern catfish industry. Phenotypic plasticity, the ability of an organism to rapidly alter gene expression to maximize fitness, is a hallmark of R-strategists and opportunistic pathogens. The phenotypic plasticity inherent in *A. hydrophila* allows v*Ah* to exploit a variety of ecological habitats and a broad range of hosts. However, it is currently unclear how, and to what extent, v*Ah* niche occupancy affects regulation of genes whose products maximize the potential for host invasion. Previous research discovered a role of extracellular proteins (ECPs) in virulence, but we do not fully understand the role of environmental regulators in toxin expression. The proposed work aims to determine the toxigenic proteins produced by v*Ah* under planktonic and biofilm-associated culture conditions by comparing ECPs secreted under each condition. Concentrated proteins will be fractionated and screened for cytotoxicity and/ or proteolytic activity. Individual proteins will be identified and sequenced by LC MS/MS-SEQUEST analysis and referenced against protein databases to determine putative protein function. Protein comparisons between growth conditions may help elucidate the environmental conditions required for host invasion and provide important information into the pathophysiology of v*Ah* in catfish.

P230 Potential impacts of pollution on the fish gastrointestinal micro biome metabolic capabilities

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Pollution in the tributaries to the Chattahoochee River affects the resident fish populations in diverse ways. Changes in water quality may alter the gastrointestinal

microbiota of these hosts. This dysbiosis could, in turn, constrain dietary options. Therefore poor water quality may produce a positive feedback loop of disturbance in these ecosystems through changes in predation. Examination of the gastrointestinal microbiota of local fish from streams with a range of exposure to pollution was conducted. Community DNA was extracted from these samples and quantification of functional genes related to sulfate and nitrate reduction as well ass cellulolysis and methanogeneis was assessed through qPCR. Preliminary results suggest that the proportion of the population capable of cellulolysis was inversely related to that capable of methanogenesis. These findings may have implications for the carbon cycling dynamics in these and other polluted waterways.

P231 Detection of nitrogen fixers that associate with *Oenothera* dune plants on Georgia barrier islands

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Due to their critical role in dune ecosystems, it is important to understand how dune plants obtain the nitrogen they require for survival. Because sand is nutrient poor, we hypothesize that some dune plants compensate by acquiring nitrogen from microbes known as nitrogen fixers. These microbes are known to associate with the roots of certain plants. Nitrogen fixers produce the enzyme nitrogenase which catalyzes the reduction of N2 to ammonia, a form of nitrogen plants can use to synthesize biomolecules such as amino acids that are required for growth. Nitrogenase is encoded, in part, by the nifH gene. To test whether dune plant roots associate with nitrogen fixers, four dune plants common to coastal Georgia (*Hydrocotyle* *bonariensis*, *Ipomoea* *pes-caprae*, *Croton* *punctatus* and *Oenothera* *humifisa*) were sampled during summer 2015 from Sapleo Island, GA. DNA was extracted from 2 root subsamples of 5 individuals for each plant type. DNA extracts were screened for the presence of nitrogen fixers using a nifH-specific PCR assay. nifH PCR products were consistently amplified from *Oenothera* specimens and sequence analysis confirmed that the amplicons represent nifH. To test whether the *Oenothera* dune plants consistently associate with nitrogen fixers over a geographical range, 2 root subsamples of 4 *Oenothera* individuals were then collected from Tybee Island, GA and PCR screened. nifH products were produced from 87.5% of these subsamples. Sapelo and Tybee nifH PCR products are in the process of being cloned and sequenced to test whether different *Oenothera* individuals associate with a specific nitrogen-fixing microbe.

P232 Contribution of decomposer fungi to the litter decomposition of two grass species, *Schizachyrium scoparium* and *Schizachyrium tenerum*.

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Jerrid Boyette, Rachel Smilo, Colin Jackson, Kevin Kuehn

In terrestrial ecosystems, most of the plant biomass produced enters the detrital pool, where microbial decomposers colonize, enzymatically degrade, and assimilate plant litter carbon and nutrients in amounts sufficient to bring about the decomposition of plant litter. Here we estimated the biomass and production rates of fungi and microbial respiration rates associated with decaying *Schizachyrium scoparium* and *Schizachyrium tenerum* leaf litter, and constructed a partial organic matter budget estimating C flow into and through fungal decomposers. Significant losses in *S. scoparium* (57%) and *S. tenerum* (68%) leaf mass were observed during litter decomposition along with concomitant increases in fungal biomass, which reached a maximum of 36 and 33 mgC/g detrital C in *S. scoparium* and *S. tenerum*, respectively. Cumulative fungal production during leaf

decay totaled 104 mgC/g initial detrital C in *S. scoparium* and 85 mgC/g initial detrital C in *S. tenerum*, indicating that 18% and 13% of the leaf litter C was converted into fungal biomass, respectively. Corresponding estimates of cumulative microbial respiration totaled 234 and 306 mgC/g initial detrital C in *S. scoparium* and *S. tenerum* litter, respectively, indicating that 41 and 45% of *Schizachyrium* leaf C was mineralized by microbial decomposers, most likely fungi. Next generation sequencing (Illumina) of fungal ITS regions identified 248 and 253 fungal taxa from *S. scoparium* and *S. tenerum*, respectively, with the majority of sequences belonging to the Ascomycota (Dothideomycetes and Sordariomycetes). These findings extend our current understanding of fungal processes in grasslands, which should be incorporated into existing models depicting major biogeochemical pathways.

P233 Antimicrobial properties and preliminary microbial ecology of leaf beetle fecal cases

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Alexandra Kurtz, Christopher G. Brown

Antimicrobials are often developed from biological byproducts, such as plants and fungi, and new antibiotics are needed to combat emerging diseases and rising rates of antibiotic resistance. However, discovery of new antibiotic classes has stalled in the last two decades. Here, we test for antimicrobial properties in the unusual architecture of case-bearing leaf beetles. Camptosomata leaf beetles incorporate plant material, feces, and secretions into protective 'fecal cases' for eggs and larvae. These cases do not exhibit fungal growth in the wild. To determine whether or not cases yield antimicrobial properties, Kirby-Bauer disk susceptibility tests were prepared using bacterial strains of *Escherichia coli*, *Bacillus subtilis*, and *Micrococcus luteus* and fungal strains of *Penicillium* and *Cladosporium*. The cases showed no apparent antiseptic properties. Rather, fungi readily grew from cases under lab conditions. Therefore, we isolated and identified the fungal diversity found on both larvae and fecal cases of six species from two genera of beetles (*Neochlamisus* sp. and *Exema canadensis*), each of which feeds on a different host plant. This research provides insight into the lack of antimicrobial properties of fecal cases, but hints at their intricate microbial ecology.

P234 Macrolichen Inventory of the Eagle Lake Watershed

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Allen Risk

Lichens are complex organisms comprised of a symbiotic relationship between algae and fungi. These organisms, due to their global range and environmental sensitivity, are reliable indicators of forest quality. The purpose of this research was to inventory the macrolichens of the Eagle Lake watershed located in Morehead, Kentucky. Specimens were collected within an elevation range of 800-1200 feet, in various forest and community types, and on bark, rock and soil substrates. The 94 collected and identified specimens comprised 50 species, 23 genera and included one rare species (for Kentucky). Several North American bio-geographical patterns were represented; nine species were Appalachian-Great Lakes, two Appalachian-Great Lakes/Pacific Northwest, twenty-four East-temperate, two East-temperate/Boreal, two East-temperate/Pacific Northwest, two Pan-temperate, and one southeast.

P235 The making of a university insect collection

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Alyssa Boatright, Katherine Braun, Catherine LaHaise, Jeffery Finney, Jennifer Zettler

As far back as 1977, students enrolled in Entomology classes at Armstrong State University have been collecting insects as an integral component of the course. Specimens were pinned, identified, labeled, and then incorporated into a teaching collection. Due to space constraints, these specimens were kept in a storeroom that also housed vertebrate and botanical specimens. In 2002, the Biology Department moved into Armstrong's new Science Center building, which allowed for the expansion of the collection. Yet the specimens remained informally organized until this past year when a multi-membered student team took on the task of reconstructing the collection. The goals of this endeavor are to have Armstrong's collection function as a repository for voucher specimens, to provide the tools for diagnostic identification purposes, and to have a teaching collection for student use and for public outreach. The members of the team were challenged with two major tasks. First, they were to organize and separate out specimens from Armstrong's teaching and research collections. Second, they were to merge specimens that have been collected since 2002 with those from the original collection. Because many of the more recently collected insects were preserved in alcohol, a storage system for vials was developed. This storage system allowed for the collection to include immature and fragile specimens that do not withstand the pinning process. As a result of these efforts, Armstrong's collection has grown to include well over 3,000 pinned specimens and nearly 1,100 insects preserved in alcohol.

P236 Utilizing Pulmonate snails as subjects in semester-long behavioral experiments to generate testable hypotheses

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Snails are often overlooked in semester-long behavioral experiments as subjects for Animal Behavior or Experimental Design biology classes. However, Pulmonate snails have a lot to offer including short reproductive cycles, simplicity in collecting and culturing, interesting behaviors for ethogram construction, and a great deal of phenotypic and life history responses to biological and physical components of their environment. I explore ways to employ Pulmonates in semester-long studies that will engage students to develop and test novel hypotheses with adequate replication based on the existing literature of behavioral and life history studies conducted on these fascinating snails.

P237 Bio-Bridge: A Research and Study Skills Bridge Program for Transfer Students

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Bio-Bridge, a bridge program targeting transfer students from local two-year institutions, has recently been implemented at Georgia Gwinnett College (GGC). The Bio-Bridge project aims to increase academic success of GGC transfer students in introductory STEM courses. To accomplish this, students participate in semester-long research projects, under the guidance of GGC Biology seniors serving as peer mentors, with embedded lessons on study and research skills. Specifically, each Bio-Bridge participant designs and conducts an independent study investigating the antioxidant properties of a chosen herbal supplement and its

effects on cultured, mammalian cells. The Bio-Bridge curriculum was piloted during the spring and fall 2016 semesters. Students gained experience in many laboratory and research techniques including literature searches, creation and analysis of graphs, experimental design, spectrophotometry, serial dilutions, redox reactions, antioxidant detection assays, and mammalian cell culture technique. Assessment of the curriculum was conducted using the Colorado Learning Attitudes about Science Survey (CLASS) and Introductory Molecular and Cell Biology Assessment (IMCA) surveys to gauge attitudes and understanding of introductory biology concepts, respectively. Here, we present our curricular design, analyses of the pilot study data, and future plans to grow and develop the Bio-Bridge program at GGC.

P238 Effects of Sleep Depravation on Biomarkers of Obesity - Sleep Quality, Perceived Stress, and Depression and Anxiety Scores among College students

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The purpose of this research project is to better understand the mechanisms connecting sleep loss and obesity. Both immuno-endocrine and genetic factors will be evaluated. In the present study, that corresponds to the initial recruitment phase of the project, nine women both self-reporting chronic sleep restriction (CSR) or not, have been included. We describe the assessment using six standardized questionnaires of psychological and behavioral factors previously related to both sleep loss and weight gain. Results show that 66.6 % of the subjects have subthreshold to moderate insomnia, and are poor sleepers. High levels of appraised stress were observed in 78% of the students, and at least 44.4 % have indexes in standardized questionnaires that indicate the presence of moderate to mild anxiety and depressive symptomatology. Further analysis of these behavioral and psychological variables should be addressed once the entire study sample is recruited.

P239 Formal involvement of students in new course development provides a unique educational experience and valuable perspective for both students and the instructor

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A common model for developing a new course is for a department or faculty member to identify the desire and/or need for a new course, develop a plan for the structure and content of the course, and then implement the new course. While student input may inform the decision to offer a new course, students are typically not formally involved in the actual development of a course. When I had the opportunity to create a new upper-level course on stem cell biology at Winthrop University, I decided to formally involve two senior undergraduate students in the development of the course. My motivation for this approach to course development was to 1) provide a unique and challenging educational experience for two advanced students, 2) better understand student perspective on the different options for course structure and content that are considered when developing a course, and 3) gain assistance with the large workload associated with developing a new course. To formalize this approach, the students were enrolled in a flexible three-credit-hour "special topics" course in the semester prior to the initial offering of the new stem cell biology course. This course provided the formal platform for our collaboration. Here, I describe the structure of my approach to student-assisted course development, the benefits and challenges of this approach, the feedback provided by the students who participated in the stem cell course's design, and the feedback of the students who took the initial offering of the course. My experience was overwhelmingly positive, and the students involved stated that they benefited in

many ways from their involvement in developing the course. This approach can be used in any discipline and is a way of offering students a unique educational experience while providing faculty with valuable assistance and perspective.

P240 Designing An Engaging Lab Manual

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A great deal of thought goes into creating textbooks that incorporate pedagogical principles, while being highly engaging for students. These principles, however, have seldom been applied to laboratory manuals. Traditional lab manuals are usually a collection of faculty-generated handouts, or a selection of pre-existing labs chosen from a publisher's database. In addition, many non-major students are unfamiliar with lab manuals and view them as an optional or low-value resource. I felt that my students deserved better! My goal was to redesign the lab manuals for two non-majors courses, General Biology Laboratory and Environmental Biology Laboratory, which cumulatively serve over 4,500 students a year. With students in mind, the new full-color manuals cover cutting-edge concepts (e.g., green building, plant tissue culture, waterborne pathogens) and are infused with interactive tools, navigation icons, and high-resolution photographs to engage students with different learning modalities. This new method of curriculum delivery has resulted in a positive change in how students view, and use, the lab manuals for these non-major biology courses.

P241 Exploration of Human Pancreatic Cancer by Undergraduates as Entry Point into Next-Generation Sequence Analysis

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Latanya Hammonds-Odie

The purpose of this project was to incorporate next-generation sequence analysis as a research model into the Research Methods in Biology (BIOL4560) course. Pancreatic cancer was selected because of the low 5-year survival rate (5%) and GGC Biology majors' interest in cancer as biological phenomena. The NCBI maintains a database of RNA sequence reads (Sequence Read Archive) from publicly-funded projects for confirmation and for new comparisons of the data. By the end of the Spring 2016 semester, the 20 enrolled students (7 research teams) worked on a bioinformatics project in which they mined RNA sequence data from the SRA database using the query "human pancreatic cancer," performed differential gene expression analysis using the Green Line of DNA Subway, researched several candidate deferentially expressed genes, and proposed a strategy for confirmation and further exploration of one or two of the candidate genes in pancreatic cancer. Students' critical thinking, reading and writing, communication, math and information technology skills were assessed by the quality of their experimental and analytical work and presentation of their research project results in journal club presentations and on-campus poster presentations. Additional data on the impact of this project was gathered from students' evaluation of BIOL4560. To determine students' enthusiasm and interest in the research project, the CURE survey as well as open-ended question survey about their attitudes toward specific aspects of the project was used. Six of the 7 student research teams completed the RNA-Seq analysis project and obtained a list of deferentially expressed genes. Only 5 of the 20 students indicated prior experience with an authentic research project at the beginning of the semester.. From the post-course attitudinal survey, students found the curriculum challenging, at times confusing, but felt a sense of accomplishment during their poster presentations.

P242 Time travel to T.H. Morgan's lab: Teaching transmission genetics by gamification

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Current laboratory pedagogy is moving toward a more realistic, discovery-based model, where students develop research directions, hypotheses, and experimental designs before carrying out their work. *Drosophila* have been used in undergraduate genetics labs to teach the concepts of transmission genetics for some time. Here, a six-week *Drosophila* project has been retooled in order to facilitate student understanding by shifting to a discovery-based experience. Students are placed into an immersive environment in which they are presented with a narrative of finding themselves alone in T.H. Morgan's lab with a portion of his lab notebook and several vials of flies. Morgan's notebook outlines future work needed to be done but only provides general goals to be achieved, such as to determine the mechanism of inheritance, map distance, and epistasis of some of the over 20 genes to be studied. A close reading of the provided notebook points students to ways of designing crosses and interpreting results. This laboratory design was developed using the six elements from Scott Nicholson's "RECIPE for Meaningful Gamification." During this experience, students appear more excited when examining the outcome of crosses and discovering relationships between alleles and genes. They are also more confident in their understanding of transmission genetic concepts. Several iterations of this six-week exercise have been implemented with either virtual flies or live flies, and it is currently being adapted for use on a web-based platform.

P243 Bridging the Genetics Gap: Combining Human Pedigree Analysis with VNTR technology for an Undergraduate Genetics Course Series Activity.

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Valerie Griesche, C. Brian Odom

The required genetics sequence for the undergraduate major at Wingate University consists of two courses, a 200-level Classical (transmission) Genetics course and a 300-level Molecular Genetics course. An exercise has been implemented in this year's sequence that employs elements from both courses into a single experience for the second semester of the course as an extension to one of the laboratory exercises that is currently on the laboratory syllabus, a lab based on VNTR (variable number of tandem repeats) analysis. In this activity extension, the VNTR analysis laboratory has been extended by the inclusion VNTR data obtained from a large, extended multigenerational family. These results have been incorporated into a large pedigree, connecting this exercise to the material from the previous semester's coursework. Students then predict the VNTR profile for selected persons, based on their position on the extended pedigree.

P244 From natural selection to classification: A new engagement curriculum to build on concepts for High School Biology

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Taxonomy is the basis of all disciplines and endeavors in need of communicating information about organisms. Humans have been classifying organisms in one way or another for thousands of years. Not surprisingly, how we classify, and consequently our resulting classification systems, have changed considerably over time. Here presented is a new outreach engagement curriculum giving students

opportunities to engage in various aspects of the taxonomic process, such as concepts in natural selection and speciation, as well as ultimately the development of their own classification trees, classifications, and taxonomic guides. The curriculum addresses several key North Carolina Essential Standards in Biology, including explaining how natural selection influences the changes in species over time, explaining the historical development and changing nature of classification systems, interpreting how DNA is used for comparison and identification of organisms, and analyzing the classification of organisms according to their evolutionary relationships (including dichotomous keys and phylogenetic trees). Rather than employing abstract or artificial creatures to reinforce key concepts, the activities are based on species native to the Southeast, contributing to building local knowledge and a sense of "place" in students.

P245 Students Take Charge: Teaching Students to Own their Education in the Introductory Biology Classroom

Virginia Young, Mercer University, Department of Biology, Macon, GA, 31207
Michael Moore

BIO 211, Introduction to Biology I, is a semester-long, five-credit-hour, freshman-level gateway course for students majoring in biology at Mercer University. Since its inception in 1997, this course has been offered on a schedule of 3 hours of traditional lecture, 3 hours of lab, and one hour of recitation (e.g., with some kind of group active-learning activity) per week. In 2014, we redesigned this course generally following the principles defined by National Center for Academic Transformation (NCAT) as a Supplemental Model of Instruction. Significant changes included the use of lecture periods for individual and small group problem-based learning, the addition of online homework modules, and the use of recitation periods to develop skills related to data analysis and writing in the scientific style. Using a parallel experimental design, we gathered data from 6 sections to evaluate the efficacy of the new approach. In the spring of 2015, two sections (N=48 students) of the revised course and one section (N=24) of the traditional design were offered. In the spring of 2016, the numbers were reversed (i.e., N=48 traditional and 24 revised). We also included in our analyses additional baseline data from 2 lecture-style sections offered by one of us (MKM) in the spring 2014 semester. Data collected include performance on shared exams (including specific learning objective and taxonomic-level analyses), student-reported analyses of study approaches, student perceptions surveys of the course and its various components, and student performance in the subsequent, second semester introductory course. Significant increases in learning outcome measures and positive student feedback clearly demonstrate the efficacy of this active-learning approach.

P246 The Undergraduate Teaching Experience

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Irma Santoro

This study investigated the effects of working as an Undergraduate Teaching Assistant (UTA) on student study methods, communication, and ability to disseminate scientific knowledge effectively. In the cohort, positive outcomes were directly linked to satisfaction with teaching performed in each laboratory. To be satisfied with their teaching, each UTA spent time preparing and reviewing material. This preparation helped to shape the way they approached the courses in which they participated as students. These changes also helped them to make career choices that aligned with their preferences towards the material and practices presented. Overall, the experience of teaching as an Undergraduate in the Biological Sciences positively impacted those students who participated in the program.

P247 A novel way to create a crime scene for forensic science classes.

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MIchael Held, Grishma Patel

One usual activity for forensic science courses is to create a crime scene and have students identify the evidence, take photos, complete a log, and in some cases package the physical evidence. We have done this for several years, but it requires dedicating an office or lab as the crime scene and a lot of time for the individual student groups to visit the scene. An alternative is to create a variety of small scenes using doll house furniture. This type of crime scene was (or will be) used for criminal justice majors, for science majors with a concentration in forensic science, for a high school forensic science course, and even for Girl Scouts completing a forensic science badge.

P248 Using Classroom-Based Undergraduate Research to Enhance Student Learning While Examining Global Change

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CEREUS (Consortium Exchanging Research Experiences among Undergraduate Students) is a National Science Foundation funded project working to address the need for more classroom-based undergraduate research experiences. Our four-institution group utilizes the expertise of project P.I.s and research students to create classroom-based research modules, focused around a single STEM theme: investigating responses of Southern Appalachian ecosystems to global change. In this project, P.I.s are creating inquiry-driven curricular modules, implementing new instructional strategies, and assessing student achievement and attitudes across four higher education institutions, including two public masters-granting institutions, a public liberal arts university, and a private liberal arts college. Modules are focused on four aspects of global change: native community responses to non-native invasive plants, phenological responses of species and communities to climate change, shifts in genetic diversity, and changes in carbon exchange patterns. This project has established a place-based educational network utilizing regional environmental issues to impart botanical knowledge while encouraging high-order cognitive processes, advancing quantitative literacy, teaching analytical techniques, honing scientific communication skills, cultivating more positive student attitudes towards plants and STEM, and improving persistence in STEM majors. To date, our interventions have created a decrease in plant blindness, the tendency of biology majors to ignore or misunderstand photoautotrophs; that decrease was statistically significant at one institution. Students have also shown a greater appreciation for the value of biological research. Future plans include 1) expanding the consortium to include other regional institutions, 2) disseminating modules to potential users, and 3) developing mechanisms for a broader conversation regarding teaching tools to help address "plant blindness" issues.

PULSE POSTERS

P301 Fostering Faculty Development to Increase Inclusiveness and Student Higher Order Cognitive Skills

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Nadia Ayoub, Marcia France, Bill Hamilton, Frederick LaRiviere

Washington and Lee University (W&L) is a small (~1,750 undergraduates) liberal arts institution. The Life Sciences includes the Biology (13 faculty, 45 majors) and Chemistry-Biochemistry (9 faculty, 30 majors) Departments, as well as an interdisciplinary Neuroscience Program (42 majors). After attending the Southeastern Regional PULSE (Partnership for Undergraduate Life Sciences Education) workshop, we developed three goals to improve Life Science education at W&L. These were to foster faculty development, encourage the use of more engaged pedagogies, and formalize metacognition in the Biology curriculum. We predicted that some impediments to successfully achieving these goals across the Life Sciences would be lack of faculty buy-in, limited time, resources, or incentives to change teaching behaviors, and lack of shared vision among departments. Nevertheless, the entire Biology Department faculty agreed to implement Bloom's Taxonomy in their courses to improve students' ability to think about learning and to realize the benefits of higher-order cognitive skills. In addition, the Provost funded a series of lunch meetings for winter of 2017 to introduce Metacognition to STEM faculty, which includes a seminar by a SERP Fellow. Across the sciences, a STEM working group has been formulating plans for improved learning spaces and development of a Teaching and Learning Center at W&L. Achieving funding for the latter is a current major goal. We are also developing assessment tools to gauge the effectiveness of explicitly discussing higher-order cognitive skills in our Biology curriculum. We will provide a case study of our work in the Introductory Biology Laboratory.

P302 SERP III: Strategies to Innovative Teaching and Overcoming Challenges at Alabama State University

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Kartz Bibb

At Alabama State University, we have had some success in implementing integrative and engaging teaching methods. Most instructors are not hard to convince that change in teaching strategies can be more beneficial to students. All of our instructors in general biology use a variety of innovative methods, including but not limited to the use of technology, case studies, etc. Implementing PULSE activities at the upper level courses is still a work in progress. What seems to be most challenging is what type of changes should take place and how those changes will be implemented. Administrators are often less flexible to changing teaching strategies because of time and financial constraints on the departments, colleges and university. As with some smaller universities and colleges, HBCUs face additional challenges such as lack of resources and high teaching loads among instructors. Since our SERP I team included the college dean and one department chair, it was easy to invite faculty of the college to engage in discussions about implementing changes in teaching strategies. College and departmental meetings provided platforms for information and open dialogue about PULSE. For faculty unable to attend these meetings, emails were sent with feed-back requests. The Vision Change Mapping Tool provided a tool for specific questions to faculty about

their teaching techniques. A substantial amount of data was collected and presented at the national conferences and local research symposia. The SERP conferences and team building among various universities and colleges have provided an opportunity for networking, rich discussions among our local faculty and implementation in the introductory courses. Our goal will be to build a stronger coalition for engaged learning and innovative methods in the upper division classes at Alabama State University.

P303 Curriculum reform: Down in the trenches, a bird's eye view

Zack Murrell, Appalachian State University, Biology Department, Boone, North Carolina, 28608
Sarah Marshburn

The Biology Department at Appalachian State University has been engaged in efforts to reform our curriculum using Vision and Change guidelines. The PULSE project was instrumental in initiating this effort, bringing a team of ASU faculty and administrators to a workshop in 2014. Departmental efforts to date have involved presentations at multiple retreats and faculty meetings. The University has awarded a 0.5 year release for co-author Marshburn to engage in a concept mapping effort and we have developed a methodology to capture faculty information regarding major concepts covered across the curriculum. Impediments to curriculum reform that have been identified to date include faculty workload issues, faculty learning curves and faculty buy-in. Efforts to address these impediments have been enacted by co-author Murrell, as Chair of the Department, through discussions and annual evaluations. Our anecdotal data indicate that departmental cultural challenges, coupled with resource limitations, are significant factors that must be addressed if we are to successfully implement changes to our curriculum.

P304 Transforming the Biological Sciences Curriculum and Instructional Program at Auburn University

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Robert Boyd, John Feminella, Bob Locy

The Auburn University plan developed by faculty in the Department of Biological Sciences (DBS) in Summer 2016 was designed to improve student: 1) cognitive skills; 2) metacognitive skills; and 3) core competencies, particularly in independent research experiences. A central goal was to create an engaged student body that understands the scientific method and acquires skills to be life-long learners, with emphasis on addressing biological issues and problems. The team proposed the following action steps: 1) acquire input from Auburn Assessment Office to improve DBS assessment plan and procedures; 2) generate course-specific SLOs and map them to DBS curriculum models; 3) implement steps to improve student, GTA, and faculty metacognitive skills in the freshman biology series and across the curriculum; 4) conduct 5-Year Academic Program Review and develop and implement a strategic plan consistent with V&C-guided priorities and vision; and 5) build collaborations with other regional universities and colleges to strengthen faculty/student diversity. Progress on each of these action steps will be reported, although much of the administrative effort has focused on preparation for the 5-Year Academic Review, the Strategic Plan, and on SLO mapping of the curriculum. Additionally, several specific actions that have been implemented related to the overall plan will be briefly presented.

P305 The Ripples Produced by Early CUREs

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Stephen Burnett, Paul Melvin, Michelle Furlong

We are presenting this project as part of a plan developed at SERP 2014 to align our curriculum to vision and change. The purpose of this presentation is to focus on the CURE (Course-Embedded Undergraduate Research Experience) aspect of our overall SERP plan. CUREs lead to a greater understanding of the process of science through the development of technical, analytical, collaborative, and communication skills. We are using introductory biology labs to develop communities of learners. Students learn the process of science in the lab, can apply to be a learning assistant in subsequent labs, and can join us in reaching out to community middle and high schools in guiding younger students in the process of science. In the lab, we acquaint students with the model organism, Callosobruchus maculatus, a bean beetle, and encourage them to develop hypotheses they could test in the lab. Initially, the entire class identifies a hypothesis to test and develops an appropriate method. Groups in the class produce and analyze data, refine their experiments and ask new questions, and present a poster to the class. Short-term outcomes following our first few semesters, led to improved written and oral communication skills, increased collaborative skills, increased analytical and technical skills, and an increased understanding of the process of science. After the first semester of implementing CUREs into the introductory class, we recruited students to become learning assistants in subsequent semester classes. The learning assistant training trains them in how to guide other students through this course. We plan to assess the growth in skills in this group of students as well as look at the impact of learning assistants on student success. We have observed more success in the labs and a greater interest in our students reaching out to community schools.

P306 That's EPIC2 (Engaging Pedagogies in Collaborative Classrooms): Metacognition and More - Adding Collaboration to Improve Science Learning

Heather Aloor, Durham Technical Community College, Science Discipline, Durham, North Carolina, 27703
Kathy Zarilla, J. Scott Stauble, Lori Khan, Olga Holgrefe

Our initial project focused on adding metacognitive strategies to our classes because of the repeated observation that many students felt their exam grades did not reflect their time and effort spent studying the course material. After the first exam, we introduced the concept of metacognition and provided examples of techniques students could use to make their studying more effective, including self-quizzing, reading for understanding, and spaced practiced. We are now adding a number of collaborative practices to our lectures and labs to both reinforce the metacognitive strategies and expand upon those techniques. We are including group test review, guided group homework meeting times, and concept retrieval practice. We piloted a weekly, mandatory, guided group homework meeting time for an introductory chemistry course during the Fall 2016 semester. Preliminary data suggest increased persistence to the end of the course and a slight improvement in final course grade average. This project is continuing through the Spring semester. Several biology labs are incorporating rapid-fire verbal quiz games to strengthen concept retrieval. Our goal is to introduce and practice skills that will improve students' abilities to effectively manage and improve their learning, while promoting collaborative study communities. Additionally, we aim to provide students with the opportunity to practice these skills with their classmates and share these techniques with others students in future classes. We believe the acquisition of these skills will transform the students' approach to learning in a positive and effective way.

P307 Longitudinal Assessment on Implementation of Curricula Changes in Southern Appalachia

Joseph Bidwell, East Tennessee State University, Department of Biological Sciences, Johnson City, Tennessee, 37614
Cerrone Foster, Anna Hiatt, Cecilia McIntosh, Rebecca Pyles

This report is a follow up on the continued progress toward development and implementation of core concepts and competencies in the department of Biological Sciences at East Tennessee State University. In addition to continued dialogue on curricula goals among faculty, the second phase included development of a longitudinal assessment plan of these concepts and core competencies. During this period an advisory board composed of program alumni in a diverse set of biology fields was created and provided recommendations on skills and experiences employers believe graduates should have to be competitive STEM fields. In addition to these suggestions, our senior capstone course was revised to where students will be able to demonstrate these competencies in preparation for professional or graduate school, or the workforce. A senior level project in this course was developed to measure these goals. This also provided base line performance of our senior level students prior to curriculum mapping and implementation of new learning outcomes and skills. This information will further direct the reorganization and mapping of the curriculum to ensure we are providing an opportunity for students to learn and practice these biological skills in preparation for career success.

P308 Ask Me What I'm Working On: A Liberal Arts STEM Cohort as a Scaffold for Undergraduate Research

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James Duchamp, Christine Fleet, Michael Puglisi

An institutional team from Emory & Henry College attended the Summer 2016 SERP-PULSE meeting at Wofford College in Spartanburg, SC. As a result of the meeting, the team developed a plan utilizing a STEM cohort model for students that targets the problem of varied levels of preparation. Using a cohort model to provide common experiences in and out of the classroom, in science courses, housing, academic support and research opportunities, we seek to build a learning community that supports students who have traditionally been at risk for persisting in STEM majors. We also plan to facilitate a strong peer mentoring program within the primary major and across majors with the STEM disciplines. As a joint effort of the Biology, Chemistry, Mathematics and Physics Departments, students will share lab science and mathematics courses during the first two years. We will also offer courses in the liberal arts core curriculum for the cohort - including a Freshman Seminar (Transitions I - team taught by STEM faculty) and a program of co-curricular activities. Additionally, students will participate in the Emory & Henry Ampersand Learning Initiative which integrates project based interdisciplinary learning throughout their undergraduate work, culminating in a day-long celebration/showcase of Ampersand student projects each Spring. In the fall of 2017, we plan to have the inaugural cohort of twenty students. With the support of admissions, we will recruit students who have traditionally needed additional support for success in STEM majors.

P309 Small Seeds of Change Can Lead to Faculty Engagement and Diverse Pedagogies.

Chrisha Dolan, Fayetteville Technical Community College, Biology/Science, Fayetteville, North Carolina, 28303

The focus of Fayetteville Technical Community College's SERP team has shifted from a pilot project within the General Biology course to division exposure and movement toward tenets detailed in Vision and Change, specifically incorporation of active learning (AL) and metacognition into instruction. While this has been a gradual process starting with a few individuals, it has developed into a community of practice within the division. The goal has been to foster faculty's belief that the reform is about augmenting their current methodologies by showcasing alternative tools that will enhance student success. This spring, faculty was surveyed to gauge awareness and attitudes towards active learning practices. Analysis of the faculty surveys allowed the facilitators to structure a two-part division-wide workshop. The first session of the workshop included discussions on AL in the classroom, including evidence of success and missteps, implementation barriers, and faculty developed solutions. The workshop facilitators employed AL activities as their presentation platform allowing the faculty to participate in demonstrations of various types of active learning exercises. Finally, faculty were asked to reflect upon topics their students found difficult or topics the faculty struggled presenting during instruction prior to the next session. The second part of the workshop allowed faculty to participate in AL strategies that they expressed interest in, while focusing on formative assessments leading to successful summative assessments. At the end of the second workshop, the facilitators used time to guide faculty in the development of AL activities they could use in their classes. This workshop and reflective view of our pedagogies was seemly well received. While division reform has taken slow root, evidence of support, implementation, and success are starting to be observed.

P310 SOARing Eagles: Student Opportunities for Authentic Research

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Charles Gunnels

Student research has been a cornerstone of the Biology degree program from its inception, primarily in the form of a three-course series: Scientific Process, Senior Research, and Senior Presentation. The Department of Biological Sciences' goal in this design was to provide meaningful research experiences for every student to foster the development of critical thinking, scientific literacy, and discipline specific writing skills. Although this course sequence provides natural scaffold from development of a scientific question, experimental design, proposal writing and peer review, through data collection, analysis, and presentation, we realize there are other opportunities earlier in our curriculum for students to advance these skills. Through the Southeast Regional PULSE (SERP) Institute in June 2016, our team developed an action plan focused primarily on developing student core competencies (writing, critical thinking, and information literacy) that align with institutional student learning goals through authentic research-embedded courses and independent research. Initial efforts center on defining core competencies in the core curriculum and assess individual instructor perception of their own success in each area. Additionally, authentic course embedded research has been piloted in the Cell Biology course as a semester-long project investigating the effects of novel compounds on HeLa cell biology. This project requires not only experimental research, but also background research of the primary literature (information literacy), scientific writing, and oral communication. Preliminary results indicate higher student satisfaction and engagement with the lab component of the course. We plan to expand similar strategies throughout our curriculum to introduce our students to the full scientific process earlier in the major and repeatedly throughout their education to develop the core competencies of critical thinking, scientific

literacy, and scientific writing.

P311 Vision and Change at Georgia Tech: Strengthening the PULSE
Jung Choi, Georgia Institute of Technology, School of Biosciences, Atlanta, Georgia, 30332
Chrissy Spencer, Shana Kerr

As a participant in the first Southeast Regional PULSE Institute (SERP I), the Georgia Tech School of Biosciences team devised an action plan that focused on 1) early access to undergraduate research, 2) encouraging student metacognitive skills, and 3) mentoring junior faculty in active learning pedagogies. We report progress in these 3 areas. We also report an example of an innovation that emerged as a result of the development of a community of faculty engaged in improving teaching and learning: the development of an online open-education resource to support a flipped learning model for our large intro biology courses.

P312 New Horizons in Biology at James Madison University
Tim Bloss, James Madison University, Biology, Harrisonburg, VA, 22807
Kyle Seifert, Joanna Mott

The James Madison University Biology Department is currently implementing the foundations for a comprehensive restructuring of the Biology Major experience, with the goals of enhancing student learning and increasing retention. Progress continues towards the goals initially developed at SERP in 2014. Funded by a 4VA grant, we've begun installing this fall a freshman year experience based on values closely aligned with the best practices of Vision and Change. The classroom experience follows a "small to big" biology format that fosters instructor ownership by allowing them to choose the subject matter of the class while integrating a common set of assessments designed to ensure consistent outcomes from class to class and year to year. The laboratory experience focuses on authentic research in which students collect samples and evaluate sequence data from an individually assigned organism, and develop projects based on this organism. This year's laboratory is focused on the DNA barcoding of organisms selected by students at the university arboretum, with the first semester results becoming the basis of a student-driven second semester project to be presented to the class. Both the classroom and laboratory experiences are designed to reinforce core concepts and competencies assessed by Vision and Change as essential for the modern day biologist. In addition, a freshman advising seminar with a strong metacognition component has been offered since the Fall of 2015. Our long term vision to increase student diversity remains via the development and implementation of an REU proposal strongly associated with the Virginia community college system. Ultimately, the vision and strategy we established at PULSE three years ago remains the same today: the development of a student-centered, engaged faculty implementing a relevant, research-embedded curriculum based on core competencies and metacognition.

P313 Realizing Vision and Change: Completion of an Undergraduate Biology Program Redesign
Lisa McDonald, Lander University, Biology, Greenwood, SC, 29649
Emily Prince, TD Maze, Elisabeth Zimmerman, Kerry Hansknecht

After attending the Southeast Regional PULSE (SERP) Institute held in June 2014, we used the Vision and Change rubrics to evaluate our program over the next academic year. Following completion of the evaluation, we began a multi-year process of completely redesigning our program in order to align it with the core

concepts and competencies of Vision and Change. Today, we are in the final stages of completing our redesign. We have developed a new curriculum structure for our majors that adds flexibility for our students while providing increased emphasis on the core concepts and competencies. In concert with the changes in structure, we have redesigned our first-year biology courses, created a required evolution course, developed more student-centered classrooms, built inquiry into our laboratory courses, and substantially increased the amount of course-embedded research in our upper-level offerings. We are currently restructuring the assessment plan for our program to ensure that we collect informative data throughout the program. Here, we present a detailed timeline of our department's journey through this process, highlighting successful strategies and describing some of the obstacles we faced along the way.

P314 Save the Bears: An Update on the Action Plan of Mercer University's Biology Department

Linda Hensel, Mercer University, Department of Biology, Macon, GA, 31207
Katharine Northcutt, Amy Wiles, Virginia Young

At the SERP 2014 conference, we developed an action plan for our department that focuses on enhancing student engagement in the classroom, incorporating authentic research in departmental courses, improving mechanisms for undergraduate research, and developing student metacognition. We have made significant progress towards these goals over the last three academic years. For example, we have developed two integrated learning programs that incorporate active learning techniques and authentic research projects. One of these is a year-long program for freshmen that includes biology, physics, psychology, pre-calculus and statistics; students in this program have developed research projects related to squirrel behavior and ecology. The second program integrates the second semester of biology with organic chemistry and mathematical modeling, and includes a research project synthesizing antibiotics that inhibit biofilms. Additional efforts to increase student success in the department include the revision of our Introductory Biology courses across both semesters; the revision utilizes the Supplemental Model of Instruction and introduces independent/authentic research into the laboratory experience. Additionally, in the current academic year, upper-level Genetics courses have been modified to include authentic research and/or "gamification" of the lab. For example, Wiles has developed an immersive genetics lab experience in which students are given a portion of T.H. Morgan's lab notebooks and asked to continue his work. This gamified experience leaves the research questions open to the students to develop. Finally, the Biology faculty members spend class time helping students think through their cognitive strategies. As a result of these and previous changes, we have already observed an increase in student success and engagement both in and out of the classroom. The majority of our department is contributing to these initiatives, and we are excited to continue improving our teaching and mentoring of students.

P315 College-wide Implementation of Adaptive Learning Tools in Non-Majors Biology Courses and Impact on Student Achievement

Alfredo Leon, Miami Dade College - North Campus, Biology, Miami, Florida, 33167

In an effort to engage students in science courses, reports have called practitioners into action to revise how the curriculum is presented to students. Some of the recommendations relating to the focus on education are discussed by the Vision and Change in Undergraduate Biology Education, report funded by the National Science Foundation (NSF), the National Institute of Health (NIH) and the Howard Hughes Medical Institute (HHMI). Adaptive learning an approach utilized as a

method of delivering instruction through computer systems, which also addresses these focus areas. Here we describe a college-wide implementation process of the BioBeyond software in various non-major Biology courses delivered face-to-face, blended, and through online instruction. Through this method, students are able to interact with content that responds the needs of the individual. Students are presented with tasks that develop their skills in observation and proper data collection processes. As they complete lessons within the platform, the program guides the student and provides feedback that directs the student to make more robust observations of subjects within the environment they are presented. Once the assignments in the platform are completed, the skills learnt in the online platform translate to the real world. Preliminary data shows that the use of the platform has a positive impact on student achievement scores in exams, compared with traditional instruction in a courses taught by the same instructor.

P316 A focus on curricular and extracurricular student engagement and critical thinking: continuing strategies to strengthen the P.U.L.S.E. of the Newberry College Biology Program

Valarie Burnett, Newberry College, Science and Mathematics - Biology, Newberry, SC, 29108
Lindsey Beebe, Charles Horn

In June 2016, a group of Newberry College biology professors attended the Partners for Undergraduate Life Science Education (P.U.L.S.E.) Institute II Conference at Wofford College in Spartanburg, SC as an alumnus team. At the initial Institute in June 2014, Newberry College attendees developed an action plan for our Biology Program. We presented this action plan to the Science and Mathematics Department and encouraged participation. The ideas presented at the P.U.L.S.E. Institute were based on initiatives described in a report entitled Vision and Change in Undergraduate Education: A call to Action, released by the American Association for the Advancement of Science. This document and the P.U.L.S.E. Institute advocated a student-centered approach to undergraduate life science education. Our Biology Program has a well-developed system of assessment, so we use our assessment data and classroom observations to identify strengths and weakness of our students and course content and to improve instructional methods. Many students continue to struggle to interpret and apply complex scientific ideas. Therefore, the main focus over the past two academic years has been continuing incorporation of activities that promote curricular and extracurricular student engagement and critical thinking skills. Some new teaching strategies and activities were introduced, and some existing assignments were modified to align them better with the goals of the P.U.L.S.E. Institute and our action plan. In the current year, we have expanded on developing activities that build critical thinking, metacognitive skills, and student engagement. We actively include more civic and academic engagement, review and presentation of literature, and data collection and analysis within our courses. Observations and evaluations of students suggest that these strategies appear to be enhancing student understanding and application of complex ideas.

P317 From Classical to Modern Pedagogy: A Case-Study…

Maureen Scott, Norfolk State University, Biology, Norfolk, Virginia, 23405

The focus of this project is to implement the suggestions of Vision and Change into the Biology department curriculum and provide students with authentic research experiences. The specific goals we set at the meeting in 2015 were to update the biology curriculum, increase course based research, increase student engagement, increase faculty participation in a continuous assessment process and focus

learning assessment techniques on higher-order cognitive skills (HOCS). The department completed a comprehensive program review process to determine which courses needed to be enhanced or eliminated. The department is now in the process of reviewing the content of these courses to ensure it aligns with the standards set forth by Vision and Change. The department has also increased the number of courses which employ the use of classroom undergraduate research experiences (CURES). Students in these courses present research posters at the Biology Department symposium. There are now six lab classes that utilize CURES and three additional labs will be added in fall 2017. Students have been very receptive to the curriculum changes and there is increased enthusiasm particularly in the lab classes. Faculty buy in has also improved as there is a renewed excitement for our curriculum and greater participation in assessment activities. The goals we have set for the next phase of the process implement use of HOCS, continue to integrate CURES into our courses, create a structured "pathway to careers" mentoring program for our students and continue our progression toward a modern pedagogy.

P318 Engaging Students Through Sustained Research Experiences

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Natalie Lenard, Ratna Gupta, Dawn Simms

As part of a collaboration with the Southeast Regional Partnership for Undergraduate Life Sciences Education (PULSE), the Sciences Department at Our Lady of the Lake College has embraced the mission to provide undergraduate students with evidence-based research opportunities to increase student engagement and scientific inquiry. Our department comprises nearly 800 students across 7 majors, with a primary focus in health professions, health service administration, and liberal studies curricula. Since 2014, our faculty have worked to develop course-based undergraduate research experiences (CUREs) as well as rigorous metrics for success, including more and better tools for student assessment of their learning gains (SALG). Additional goals related to the mission have included modifying course learning objectives, providing faculty professional development opportunities and increasing collaborations across departments and institutions. Today, CUREs projects are integrated into several of our biology, chemistry, and mathematics courses, including a majority of science laboratory courses. Positive student feedback lead directly to the creation of a new concentration in the biology program, i.e., Biochemical Analysis and Instrumentation (BAI), which focuses on instrumentation, data analysis and chemistry curriculum for students interested in pursuing graduate school or careers in research. A Board of Regents state grant award helped strengthen two of our research-focused courses and allowed for the opening of a new tissue culturing laboratory. We developed the Supervised Independent Research Experiences (SIRE) program to award a stipend for students which complete and present a semester-long independent research project in biology or chemistry. Faculty participate in professional development activities to better align learning objectives to Quality Matters standards, improve student engagement and better assess student learning. Assessments of student learning outcomes show a significant increase in learning gains and overall improvement in student engagement. Institutional collaborations include local community colleges and our new community partner, Boys Hope Girls Hope.

P319 Aligning the Radford University Biology Program with *Vision and Change*: Action steps toward improving core competencies and metacognitive skills through student-centered learning and authentic research

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Tara Phelps-Durr, Jeremy Wojdak, Sara O'Brien, Jeanne Mekolichick

Radford University is a public, comprehensive university of 9,400 students in southwestern VA. Within the Biology program, Radford faculty strive to actively engage and challenge our 450 students in and out of the classroom. However, coordinated efforts at systematic improvement have not come to fruition. In June 2016, a team representing Radford University's Biology Department was invited to attend the Southeast Regional PULSE (SERP) Institute. Prior to the SERP Institute, the Biology Department met to consider strengths and weaknesses of the curriculum and our vision for the future. During the Institute, our team evaluated how the Biology program aligned with *Vision and Change*, interacted with PULSE fellows and others who have implemented *Vision and Change* curricula at other institutions, and created an action plan for improving the educational experience for Radford University undergraduate students. Our action plan priorities were to improve core competencies and cognitive and metacognitive skills by integrating student-centered learning and authentic research across the curriculum within 5 years. Since the SERP institute, we organized a department retreat, passed a resolution to officially incorporate *Vision and Change* into our curriculum, and discussed how to implement our action plan. Discussions at our retreat were guided by our guest speaker and PULSE fellow, Dr. April Hill. Subsequently, our department organized small faculty teams to investigate specific actionable steps for achieving our long-term visions and established discussion groups focused on engaging pedagogies, course-embedded research, metacognition, teaching large classes, and a faculty development book club. The Radford University Biology Department had been working to enhance educational experiences for our students for many years; attending the SERP Institute and interacting with PULSE fellows provided us with the necessary catalyst to create a shared vision and take actions to make our departmental vision a reality.

P320 Experiments in Re-designing Introductory Biology to Align with Vision and Change

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Rollins College is a small private liberal arts college that services approximately 180 undergraduate majors in the biological sciences. Although our introductory biology courses were already re-designed three years ago to focus thematically on specific topics in depth (rather than breadth) and to emphasize critical thinking outside of the textbook, we are experimenting with additional improvements of the introductory biology sequence inspired by last year's SERP meeting. This academic year we focused on incorporating tools that promote metacognition in the first semester and on embedding an authentic semester-long research project in the second semester. Developing student metacognition involved class discussion of study habits, in-depth reflections of test outcomes, and assessing competency in understanding biological mechanisms. Authentic research involved students participating in a study characterizing a zebrafish CRISPR mutant in terms of regeneration and behavior. Although students appreciated the continuity of their experiments and the privilege of doing "real research", they did not score significantly higher on the EDAT or LCAS. These data, however, were confounded by a number of variables, including

GPA and professor differences, student choice, and the fact that our "traditional" labs already incorporate a fair amount of experimental design. In the coming months, the Biology department will review these data and map the curriculum according to best practices.

P321 A Chance to be Creative: Assessing the Department of Biology at Samford University

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On June 1-4, 2016, Samford University sent a team from the Department of Biological and Environmental Sciences to the second Southeast Regional PULSE (SERP) meeting at Wofford College. While there, the team learned about how to evaluate the Department at a program level, rather than at an individual course level. As a result of the meeting, the team developed an action plan which included determining student learning outcomes and developing a curriculum map for Biology majors showing where the learning outcomes would be assessed. The plan also included a procedure for assessing the learning outcomes and making any changes in the program based on the assessment. Just before classes started in the fall of 2016, the Department faculty met and ratified an earlier mission statement, drafted a set of five learning outcomes (derived from the 2010 Vision & Change in Undergraduate Biology Education document), and identified the Biology core courses where the learning outcomes would be assessed. In addition, the Department expressed a desire for faculty to meet informally to discuss teaching and assessment pedagogies that might prove useful in other Biology courses. The final aspect of the action plan to be instituted will be program-level assessment. The Department feels that the SERP conference served as an excellent way to perform program-level without the need for external reviewers. The team felt, however, that the entire department needed to be included in any program-level changes. The Department now has an action plan that can be used to guide curriculum and hiring decisions for the future.

P322 Shaw on a Mission through Vision and Change

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The mission of the Bachelor of Science Program in Biology at Shaw University is to teach high quality science courses; prepare students for entry into graduate or professional programs through comprehensive course requirements; and to provide academic and professional enrichment for students who desire to pursue careers in biological sciences. The main goals of the Bachelor of Science Program in Biology at Shaw University are to (1) increase student retention and (2) enhance student metacognitive skills. To accomplish these goals, the Vision and Change in Undergraduate Biology Education: A Call to Action's charge to (1) engage students in the process of science and (2) present science as a vibrant, active field was implemented by faculty through increasing student-centered classrooms. Furthermore, the appreciation and embracement of diverse learners was exercised in the courses. Various active learning and pedagogical activities were included in the learning environment to touch upon the learning styles of each student. Through these efforts, there has been an increase in student retention. Additionally, the Biology Curriculum Map was revised by aligning the Program Learning Outcomes with the Vision and Change Core Concepts for Biological Literary and Student Learning Outcomes of all courses within the program to reflect the Vision and Change Core Competencies and Disciplinary Practice. To further strengthen the

division, Interdisciplinary teams continue to be formed and HIPS activities, such as weekly seminars, learning communities, collaborative assignments, undergraduate research, have increased.

P323 Tackling Curricula Reform using *Vision and Change*: Efforts at a Research-Intensive University

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Peggy Brickman, Paula Lemons, Russell Malmberg

In June 2016, a team of three faculty and one administrator from The University of Georgia attended the Southeast Regional PULSE (Partnership in Undergraduate Life Sciences Education) meeting. They left with three (scaffolded) action plans to begin the process of aligning undergraduate Biology degree curricula with *Vision and Change*: three months, next academic year, and beyond one year. This poster reports on progress to date. UGA PULSE team meetings occurred regularly throughout summer and fall semesters in order to address the action plans. Also during the fall semester, two team members met multiple times with life sciences department head stakeholders regarding PULSE team efforts, and PULSE team members revised the Student Learning Outcomes (SLO) Assessment plan for the Biology degree program such that it aligned with Vision and Change. This plan was distributed to other life science departments as a potential model assessment plan for curricular reform. In January 2017, the PULSE team facilitated the first ever teaching retreat for instructors of Biology major core courses. The goals of the retreat were to give participants a chance to 1) exchange ideas and strategies with instructors for the same course and within courses; 2) learn about the broader life sciences curriculum at UGA; 3) begin drafting SLOs for specific courses, which could be used in either the Biology degree SLO Assessment plan or that of a different life sciences degree program. Based on participant feedback, the retreat was deemed a large success: Goals 1 and 2 were met and Goal three was met to a lesser degree. Plans are underway for continued informal meetings for retreat participants to give updates on their progress during spring semester. Additional future plans include identification of a team (fall 2017) to engage in a Biology degree curriculum-wide mapping process aligned with *Vision and Change*.

P324 Transforming Education by Enhancing Student Metacognitive Skills

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Sushma Krishnamurthy, Srinivas Garlapati, Ann Findley

The University of Louisiana at Monroe is a public 4-year R3 institution with a total fall 2016 enrollment of 9115 students, 320 of which are undergraduate biology majors. We have set as a priority and vision for the biology program the enhancement of the metacognitive skills of beginning students through a concerted strategy that involves the introduction of early intervention in the lecture classroom and authentic course-based research in the laboratory. Our motivations for seeking these improvements include: improving student retention within the biology program; improving course quality; and, creating a pipeline for the M.S. We have identified the challenges to achieving these goals as: faculty buy-in; limited resources; concerns about scalability; and, the need for leadership development. We have taken immediate steps to: share our vision with program colleagues and administrators; gather feedback via the PULSE Snapshot Rubric v2.0 to develop a consensus for a path forward; introduced metacognitive strategies in several entry-level biology lecture courses; and, restructured the molecular biology and biotechnology concentration within the B.S. Biology degree program to incorporate multiple genuine course-embedded research experiences to enhance metacognitive

skills. We present assessment results from our initial attempts to incorporate metacognitive strategies in several targeted lecture and laboratory course offerings and provide a consensus report of action steps to be addressed during the remainder of the academic year and beyond.

P325 Taking the PULSE at UNCW: A plan for curriculum review and change, Department of Biology and Marine Biology

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Joseph Covi, Ann Pabst, Martin Posey, Amanda Williard

The University of North Carolina Wilmington is a comprehensive university that serves 13,000 undergraduate and 1,600 graduate students. We have a strong emphasis on undergraduate education, especially with respect to engaging students in applied learning outside of the classroom. The Department of Biology and Marine Biology is a campus leader in teaching and research, with undergraduate and master's degrees in both biology and marine biology and a PhD in marine biology. Participation by our faculty in the PULSE-SERP Institute is motivated by a strong desire to bring into the classroom the rigorous and active student experience that is found in the applied learning setting. The timing of this participation is especially fortuitous, as the university has adopted applied learning as the central component of its Quality Enhancement Plan as part of its accreditation with SACS-COC, and the department has embarked on a strategic planning process that includes a review of our curriculum. We initiated a departmental discussion of Vision and Change and evidence-based teaching. Currently, departmental faculty members are engaged in an ongoing discussion of teaching practices that is parallel to our discussion of curricula. To encourage the adoption of scientific teaching and student-centered learning in the classroom, we have invited national experts to present workshops focusing on scientific teaching and metacognition. We are also engaged in several proposals to the National Science Foundation to facilitate this transformation at the department level and throughout the university.

P326 Development and Initial Implementation of the Winthrop University SERPII Action Plan

Matthew Stern, Winthrop University, Biology, Rock Hill, SC, 29733
Matthew Heard, Karen Kedrowski, Dwight Dimaculangan

A team consisting of two Biology faculty, the chair of the Biology Department, and the Dean of the College of Arts and Sciences represented Winthrop University at the second Southeast Regional PULSE Institute (SERP II). The goal of our participation was to build upon our recent work to drive change within our department and institution that is guided by the recommendations of Vision and Change. The action plan we developed focuses on increasing the use of active learning strategies within our department and identified three priorities: 1) faculty development, 2) curriculum revision, and 3) expanded use of metacognitive strategies. We presented the action plan at our fall departmental retreat and administered a survey to obtain feedback and gauge support of our general plan and interest in the more specific proposals we put forth. The survey revealed that our faculty have a strong interest in participating in professional development opportunities related to implementation of engaging pedagogies in their courses, improving course-level assessment, and becoming more active in the scholarship of teaching and learning. Our survey also showed that over 90% of Winthrop Biology faculty believe that the core of our biology curriculum is in need of revision. Guided by these results, we went on to develop a multi-pronged approach to providing faculty development opportunities, which we will be rolling out in spring 2017. In

addition, we have moved forward with discussion of curricular change at departmental meetings. This includes the formation of subcommittees to assess upper-level core courses as well as productive discussions of the potential adoption of a revised introductory course model. The action plan developed at SERP II is thus serving as a catalyst for our department's continued effort to improve our curriculum and pedagogical approach as we integrate the recommendations of Vision and Change into our program.

P327 Transforming the Culture for STEM Teaching and Learning

Angela White, North Carolina A&T State University, Biology/ College of Science & Technology, Greensboro, NC, 27411
Grace Byfield, Kelsie Bernot, Roy Coomans, Jian Han, Robert Newman, Pameeka Smith Pearson, Misty Thomas, Catherine White, Mary Smith

The Department of Biology at North Carolina Agricultural and Technical State University is striving to become a transformative department that engages faculty in inspiring students to become deep and reflective thinkers, prepared to navigate STEM careers successfully. Prior to attending the summer 2016 SERP II Institute in Spartanburg, South Carolina, the biology faculty at NC A & T took the SERP Survey to assess the department's progress relative to Vision and Change. The results of the survey were used to establish an action plan to advance our vision to transform teaching and learning in our department. At the SERP Institute, we developed an action plan to improve 1) students' metacognitive thinking 2) engaging pedagogies and 3) students' cognitive skills. During the course of the year, we implemented several Course-based Undergraduate Research Experiences (CURES) in courses across the curriculum as engagement strategies for developing our students' core competencies in the biological sciences. We will present a map to demonstrate how the competency skills are scaffolded across the curriculum and tools for assessing learning.

P328 Investigating the Impact of Collaborative Make-up Exams

Wilfred Amoako, North Carolina Central University, Department of Biological and Biomedical Sciences, Durham, NC, 27707
Gail Hollowell, Wendy Heck-Grillo, Mabel Royal, Amal Abu-Shakra

Collaborative make-up exams (CME) were used in the course Biology 1201 (Principles of Biology: Organisms and Diversity) over three consecutive semesters-Fall 2014, Spring 2015, and Fall 2015(n=210 students). Visually informative Scatter plots were generated to depict grade spread in a set of comparisons per exam and per semester for a total of 9 individual exams (three per semester) and their 9 corresponding CME. Line charts generated of the differences between the individual exam grades and the CME grades exhibited increases up to 60 points in the CME grades, while also showing cases in which few students scored lower on the CME (down to 20 points) than on the original exam. Students also completed the CME questionnaire at the end of the semester that provided valuable data and reflective individual feedback.

P329 Biologists engaged in Consensual Curricular Revision

G. R. Davis, Wofford Colelge, Department of Biology, Spartanburg, CA

Our four course biology core curriculum (sequentially Bio 150, 151, Genetics, and Cell Biology) has worked well since its implementation seven years ago but students must identify as biology majors in the first semester. First year courses Bio 150 and 151 emphasize reading and understanding scientific literature, experimental design, data collection and statistical analysis culminating in group

presentations and/or scientific posters. Non-biology majors take Bio 150 and 151 to satisfy the general education requirement for two lab courses. We have grown frustrated that most students in Bio 151 are incapable of fully appreciating the implications of evolutionary developmental biology (EvoDevo) that we try to squeeze into the final two weeks of that course. This is one of several reasons motivating our curricular overhaul. Aware that discussions could be cumbersome if all 13 full time Biology faculty were involved, we began the process with only four (the Curriculum Working Group) who carefully considered several options and their implications for biology majors and students from Chemistry, Psychology and other disciplines who rely on these courses. After summer meetings by the CWG and fall meetings of the CWG and the entire biology faculty for feedback and discussion, replete with several on-line surveys and votes, we have reached a consensus to restructure the core to three courses (Bio 150, Genetics, and Cell) to be completed within the first four semesters and a fourth integrative course to be taken anytime during the last two years when students have the academic maturity to more fully grasp the significance of EvoDevo, the emphasis in this new course. The procedural timeline along with additional justifications for these major changes are provided in our poster which describes how we obtained approval from affected departments before bringing this matter to the College Curriculum Committee for final approval.

ASB 2017 ADDENDA

CHANGES

Room Changes	ASB Past Presidents' Breakfast Meeting, Thursday, 7:00 AM – 8:15 AM. New Location: Riverview 1.
	ASB Business Meeting, Friday, 5:00 PM – 6:00 PM. New Location: Alabama E. (All ASB members invited.)
Poster → Talk	P208 The Effect of Progesterone on the Endogenous Production of Nitric Oxide & Tumor Necrosis Factor in RAW 264.7 Cells • Christopher Brandon, Bagie George *Takes place in Cell and Molecular Session*
Poster moved from Friday to Thursday	P104 *Nyctiellus lepidus* population structure in the Grand Bahamas Bank • Samantha Johnson, David Reed
	P119 Elemental defense of seeds by a nickel hyperaccumulator against a generalist seed herbivore. • Katherine Mincey, Robert Boyd
Revised abstract	[50] Tracking dispersal and habitat use of neonatal copperheads (Crotalinae; *Agkistrodon*) using harmonic radar technology. Iwo Gross, Yong Wang

Studies evaluating the effect of forest management on the habitat preferences of nesting snakes and their dispersing offspring are limited, despite the importance of these age cohorts to population viability and genetic diversity. Recent studies have identified the neonatal snake cohort as an important dispersal vector in several species. Unfortunately, the comprehensive examination of early-life characteristics in snakes is logistically challenging because of ineffective tracking techniques and low detection probabilities *in situ*. During the 2015-2016 activity seasons, we examined the activity patterns and microhabitat use of newborn copperheads (*Agkistrodon contortrix*) in Bankhead National Forest in northern Alabama. Gravid female copperheads were implanted with VHF radiotransmitters and tracked periodically until mid-August when they were placed in hardware cloth exclosures at their parturition sites to give birth. Neonates were implanted with harmonic direction finder (HDF) tags after their initial ecdysis, and tracked daily. Case-control microhabitat surveys were conducted alongside natal tracking efforts. Microhabitat use was analyzed using conditional logistic regression within an information-theoretic framework. Our analysis revealed that neonates chose locations in closer proximity to course woody debris and woody undergrowth than what was available. Neonates exhibited a characteristic

"beads-on-a-string" dispersal, punctuating step-wise movements with stops at woody shelters. Our findings indicate that recently managed areas provide neonatal copperheads with a patchy distribution of suitable thermal conditions and physical retreat sites reminiscent of naturally occurring early-successional habitat. We will also give an assessment of the HDF system as a telemetry tool, and recommend potential applications for HDF technology is vertebrate spatial analysis.

ADDITIONS None

WITHDRAWALS [75] Understanding the Past, Present, and Future of Land Conservation in South Carolina • Nicole Berson, et al.

[138] Examining the effect of convallatoxin, a cardiac glycoside, on the growth of colorectal cancer cells • Sarah Anderson, Chris Barton

P019 Egg and Hatchling Size from Two Populations of *Gopherus polyphemus* in Southeastern Georgia: Effects of Habitat Quality • John Levengood, David Rostal

P093 The architecture of genomic cohesion among locally adapted *Helianthus annuus* (Common Sunflower) populations • Michael Kartje, Mark Welch

P105 Barcoding Metro Atlanta Birds • Dustin Root et al.

P137 Investigation of the identity, bioaccumulate in aquatic biota, and toxicity bioassay of polychlorinated biphenyl (PCB) congeners in the Coosa River and its Rome tributaries in Floyd County, GA. • Christopher Elsey et al.

P188 An investigation into population structure and gene flow in North American *Castanea* Mill. (Fagaceae) • Jesse C. Harris et al.

SIXTIETH ANNUAL MEETING

BETA BETA BETA
SOUTHEASTERN REGION

DISTRICTS 1 and 2

MEETING JOINTLY WITH THE
SEVENTY-EIGHTH ANNUAL MEETING OF THE
ASSOCIATION OF SOUTHEASTERN BIOLOGISTS

March 29-April 1, 2017
Montgomery, Alabama

DISTRICT I BROOKS AWARD SESSION--WINNERS

First Place Winner of the District I Brooks Award

Parker, Taylor; Carmony Hartwig, Richard Macri, Jay Bolin. Tau Eta, Catawba College. Citrus extracts as natural larvicides against *Culex* mosquitoes

Although several mosquito species fulfill important ecological functions by serving as food sources and floral pollinators, some additionally serve as vectors that promote pathogen transmission. As with antibiotics, insecticides are becoming less effective as mosquitoes develop resistance against them. Synthetic insecticides like DDT can also have detrimental effects on natural ecosystems and the overall health of untargeted species. The use of natural plant extracts as insecticides offers the ability to reduce mosquito populations with a compound that is biodegradable, target-specific and less likely to develop resistance amongst mosquitoes. Many members of the family Rutaceae are proposed to contain insecticidal properties associated with their peels, leaves, and seeds which may be attributed to the varying amounts of limonoids that have demonstrated activity against third and fourth instar larvae of *Aedes albopictus*. In order to concentrate active liminoids and other potential larvicidal compounds from plant material, we performed a steam distillation on fruit peels of *Poncirus trifoliata*. Here we discuss the collective results of the concentrated volatile essential oils of *P. trifoliata* against *Culex restuans* larvae and our future work toward determining purified volatiles with larvicidal activity.

Second Place Winner of the District I Brooks Award

Pimentel, Jasmin. Sigma Psi, Florida Institute of Technology. Inorganic Pyrophosphatase modulates paralysis in an Alzheimer's disease model

Aging and its associated pathologies are one of many current scientific and medical mysteries, many details about the molecular basis of these diseases are not known. One of these pathologies is Alzheimer's disease (AD). AD is associated with misfolding of the amyloid-β peptide. When incorrectly folded, the protein aggregates in the brain forming amyloid plaques. The heat shock response (HSR) senses proteins misfolded due to stressors, and induces a set of molecular chaperones that restore a protein's native state. HSR induction is beneficial in animal models of protein misfolding diseases like AD. In an AD construct of *Caenorhabditis elegans,* positive and negative regulators of the HSR were screened and positive regulators consistently showed paralysis of the worms and effective negative regulators reduced paralysis. An effective negative regulator, inorganic pyrophosphatase (*pyp-1*), is a subunit of the Nucleosome Remodeling Factor involved in epigenetic modifications of the chromatin. Changes in epigenetic modifications have been associated with aging as well as a correlation between neurodegenerative diseases and epigenetic modifications. Further analysis of the *pyp-1* locus revealed several protein isoforms interacting differently with the HSR. Knockdown of both isoforms resulted in full reduction of paralysis compared to the full *pyp-1* knockdown. Both isoforms also exhibit less heat shock induction compared to the full *pyp-1*. We suggest that the isoforms chronically regulate Pyp-1 levels after heat shock induction to reduce paralysis.

Third Place Winner of the District I Brooks Award

Martinez, Sebastian. Sigma Psi, Florida Institute of Technology. Factors affecting anuran presence in Brevard County, Florida

Anuran (frogs and toads) species are excellent indicators of wetland quality; high abundance and diversity of anurans are usually indicative of high-quality habitats. Anurans are relatively simple to study during their breeding season by monitoring their calls. Choruses of >3 overlapping callers may reflect a robust local population and indicate a suitable habitat for breeding. Thirteen anuran species can be found in Brevard County, FL. Amphibian populations are declining and the leading cause of these amphibian population collapses not related to chytridiomycosis is habitat destruction. This study consisted on assessing the relationship between anurans and urbanization in Central Florida. Over the last three years, I have analyzed over 400 recordings of 21 wetland sites in Brevard County, Florida. Using Google Earth Pro and ArcGIS (Geographical Information System), I mapped wetlands and urbanized areas inside 100 m, 200 m, and 1000 m buffers surrounding each site. Preliminary results using the mvabund multivariate package in R, have suggested that total species richness has a statistically significant negative relationship with urbanization.

Honorable Mention Winner of the District I Brooks Award

Hoffman, Audrey. VOC interference limits host detection of the parasitic plant *Cuscuta gronovii*

Parasitic plants are angiosperms that parasitize other plants using a highly-modified root called a haustorium, a specialized structure to penetrate host cells and take up nutrients and water. *Cuscuta* (Convolvulaceae), also known as dodder, are holoparasites known for causing major crop damage. *Cuscuta* species use host volatile cues to locate and select hosts. The purpose of this study was to determine if volatile organic chemicals (VOC) interference may inhibit the ability of *C. gronovii,* a common species in North Carolina, to find a suitable host. This study used coleus plants as the host and a commercial product that emits VOCs as the source of VOC interference. Three trials were established to determine the impact of VOC interference, where *C. gronovii* seedlings were placed in a petri dish and given a choice between two options: 1) soil vs. coleus plant, 2) VOC source vs soil, and 3) VOC source vs coleus. The seedling host choice was recorded 72 hours after germination. Results of this study indicate that *C. gronovii* can detect and direct growth towards coleus, but in the presence of a commercial product that emits VOCs, the ability of the seedling to direct growth towards the coleus was significantly inhibited.

District I Brooks Award winners (left to right): Taylor Parker, Jasmin Pimentel, Sebastian Martinez and Audrey Hoffman

DISTRICT I BROOKS AWARD SESSION--OTHERS

Mandujano, Viridiana (Karina Noyola-Alonso; Jay F. Bolin). Tau Eta, Catawba College, Department of Biology, Salisbury, NC. Molecular and microscope identification of arbuscular mycorrhizae in quillworts (*Isoetes*; Isoeteaceae)

Aquatic and semi-aquatic plants form a variety of associations with arbuscular mycorrhizae (AM) but those associations are understudied relative to terrestrial plants. The Lycophyte genus *Isoetes* represents an ancient lineage and may provide insight into the evolution of AM associations. Fossil data from Carboniferous era ancestors of lycophytes demonstrate that the co-evolution of lycophytes and AM dates to at least 300 million years before present. Only a handful of *Isoetes* spp. have been evaluated for the presence of AM and no studies have been conducted in the New World. We collected *Isoetes melanopoda* subsp. *silvatica* (from two locations), *Isoetes engelmanii,* and *Isoetes microvela* from the piedmont and coastal plain of North Carolina to determine the presence of AM, and if present to identify the AM species. We used *Glomus* specific AML1 and AML2 PCR primers to amplify AM fungi from whole root DNA extracts. Cloned PCR products indicate the presence of *Glomus* AM associates in all root samples analyzed. We will compare the *Glomus* isolates sequenced from the various *Isoetes* spp. and present a phylogeny using published Glomeromycota data. Epiflourescence microscopy showed hallmarks of AM infection, including fungal vesicles and hyphae in all *Isoetes* root samples observed.

Bai, Yuting. Sigma Lamda, Wesleyan College. The effect of Zinc (Zn2+) on Uterine Smooth Muscle Cell (UTSMC) proliferation

Zinc is an indispensable trace metal found in the human body that exerts a multiplicity of effects on cell activities such as proliferation, metabolism and apoptosis. Zinc also has an important role as an antioxidant and as a participant in tissue remodeling through its facilitation of matrix metalloproteinase function. In the uterus, smooth muscle cells exhibit hypertrophy and hyperplasia under appropriate hormonal stimulation. In addition, smooth muscle cells are active in the deposition of extracellular matrix. In approximately 20-40% of women in the United States, benign uterine smooth muscle tumors (leiomyoma) develop, which exhibit dysregulated cell proliferation and abnormal deposition of extracellular matrix proteins. To examine the influence, if any, of Zinc on uterine smooth muscle cell proliferation, primary cultures of normal human uterine smooth muscle cells (UTSMC) were exposed to a range of $ZnCl_2$ concentrations. The data indicate that zinc treatment enhanced UTMSC proliferation at 80μM levels, but inhibited proliferation at a treatment of 120μM. The ability of zinc to improve proliferation of UTSMC has implications for optimizing culture conditions for these primary cells and may provide insight for future experiments examining the role for this ion in uterine smooth muscle cell function.

Perez, Amanda; Schroeder, Wanda, Sigma Lambda Chapter, Wesleyan College. Analysis of FOXA1 and ERα Expression in Cervical Cancer

Estrogen, the primary female sex hormone, is important for growth, development, and upkeep of secondary female characteristics and reproduction. Estrogen regulates the transcription of estrogen responsive genes by binding estrogen receptors (ER's) and by forming an estrogen+ER complex that binds to estrogen response elements (ERE's). Previous studies have shown that FOXA1 is required for the binding of ER's to chromatin, and the knockdown of FOXA1 expression inhibits the binding of ER's and subsequent changes in gene expression. FOXA1 is thought to act as a pioneer transcription factor, capable of beginning chromatin opening. Studies have examined the expression of ER's and FOXA1 in breast and prostate cancers. Although a link between ER's and FOXA1 expression has been determined in these cancers, to date the relationship of the

expression of these two genes has not been examined in cervical carcinoma. Therefore, the current study examined the expression of ERα and FOXA1 in a breast carcinoma cell line, CRL-1500, and three cervical carcinoma cells lines, HTB-31, HTB-33, and HTB-35 of different tumor grades and HPV expression. The elucidation of ERα and FOXA1 expression in these cervical carcinoma cells should provide valuable information on the role of FOXA1 in cervical cancer development.

Brown, Daniel, Kaitlin Pepper, Kaitlin Ramspeck, and Mark Davis. Psi Rho Chapter, University of North Georgia. Shoulder That Load and Walk: Foraging Dynamics in Leafcutter Ants.

We investigated aspects of foraging ecology in leafcutter ants (*Atta cephalotes*) in the montane cloud forest near San Luis, Puntarenas, Costa Rica in June 2016. Fifty ants transporting leaf fragments (laden foragers) in each of nine foraging columns (six day columns, three night columns) were captured and their head size and size of the transported leaf fragment measured. We assessed transport burden of foragers, quantified hitchhiking behavior of the minim worker subcaste (ants riding on fragments carried by laden foragers) in day and night foraging columns, and filmed columns to assess the ratio of foragers and defensive soldiers in attendance. Mean leaf fragment wet mass was 2.03x greater than the mean wet mass of the forager transporting the fragment, and the surface area of transported leaf fragments increased with forager size. Hitchhiking behavior was more common at night and larger fragments had more hitchhikers. Transport burden and the ratio of foragers to defensive soldiers were similar in day and night foraging columns. Our results on cloud forest *Atta* are generally consistent with those published on foraging ecology in other *Atta* species in lowland (and other) forests. Foraging dynamics in the genus *Atta* seems conservative across taxa.

Delgado, Kelly; Stephanie Unkles, Alan Valdiviezo, Kingsley Dunkley. Genetic Response of *Shigella flexneri* 2a Strain (ATCC 29903) Grown in LB broth at Different pH

S*higella flexneri* are gram-negative bacteria that invade the colonic and rectal epithelium causing 1.1 million deaths annually. In this study, we evaluated the optimal pH growth of *S. flexneri 2a strain* (ATCC 29903) *in vitro* and determined the relative expression of virulence gene, *virF*, and glutamate-dependent acid resistance (GDAR) pathway genes, *gadB* and *gadC*, which allow this microorganism to flourish. *S. flexneri* was grown in LB broth at pH 5.0, 7.0 and 8.0. Our results revealed that *S. flexneri* had the highest growth rates at pH 7.0 and 8.0 with the highest log number obtained at pH 8.0. For all samples, exponential growth phase started at 2 hrs while stationary phase began between 4 and 6 hrs. Although each treatment started at a different pH, the data showed a consistent pH (4.5-4.8) in all groups after 6 hrs of incubation. Our experiment indicated that *S. flexneri* expresses *gadB*, *gadC*, and *virF* at all three pH during exponential growth. At the initial pH levels of 5 and 8, expression of the three genes decreased at the later time points suggesting these genes were induced early during *S. flexneri* growth.

Schlaudt, Joel; Katherine Shumaker, Aurdrey Hoffman, Joseph Poston. Foraging choices of American Beaver (*Castor canadensis*): effect of tree species, diameter, and distance from water.

The North American Beaver (*Castor canadensis)* is well known as an ecosystem engineer. They often transform entire landscapes by cutting down trees and flooding areas through the construction of dams. In wetlands and riparian ecosystems, they aggressively select and cut down deciduous trees near water for lodge and damn construction and food. This study examined the foraging preferences of beavers in a central piedmont North Carolina pond. In fall 2016 we examined the browsing preferences of beavers by recording tree species, diameter, and distance from water of browsed trees;

sample areas included five locations around the pond, with 16 transect plots in each area. There were 25 tree species observed, two species were preferred, and two species were avoided. We found the preference and avoidance of tree diameter the beavers cut or avoided for each species, and for all trees in the study. For the favored species of trees, we found the beavers showed preference in a distance from the water's edge they would cut down trees. In the plots a total of 525 trees were measured for each of the preference factors. This study provides a snapshot of beaver foraging preference.

Booth, Charles E. Nu Upsilon, Bridgewater College. Expression of the Poly-hydroxybutyrate Depolymerase Gene of *Streptomyces* sp. 5A in *Streptomyces lividans* TK24

Polyhydroxybutyrate (PHB) depolymerase is an enzyme produced by the bacterium *Streptomyces* sp. 5A to degrade the large polymer PHB into monomers that can then be taken into the cell and catabolized. The mechanism for regulating its synthesis is not known at present. In order to elucidate the mechanism, western blotting with specific antibodies would allow the monitoring of PHB depolymerase synthesis. In order to obtain antibodies, purified PHB depolymerase must be obtained in milligram quantities from *Streptomyces* sp. 5A, which is currently not possible. Thus, we attempted to clone and overexpress the gene that corresponds to the PHB depolymerase (phaZ) of this organism, in the heterologous host, *Streptomyces lividans* TK24. The phaZ gene was amplified by the polymerase chain reaction (PCR) and cloned into *Escherichia coli* TOP10 using a TOPO®-TA cloning vector. The phaZ insert in the TOPO vector was transferred to the shuttle plasmid, (pIJ86), producing a pIJ86-phaZ construct. This construct was successfully introduced into E. coli 12567/pUZ8002 by electroporation. The construct from this strain was successfully cloned into *S. lividans* TK24 by interspecific conjugation. However, the gene was not expressed in this organism, possibly due to genetic barriers between *Streptomyces* sp. 5A and *S. lividans* TK24.

Neave, Erika. Florida Institute of Technology, Sigma Psi. Are cell counts a viable proxy for the toxicity of Florida Red Tide?

DISTRICT II BROOKS AWARD SESSION--WINNERS

First Place Winner of the District II Brooks Award

McDonnell, Anna Margaret and Chris Barton. Mu Theta Chapter, Belmont University. Anti-proliferative effects of epigallocatechin-gallate and enoxacin on cervical cancer-derived cells in culture

Cervical cancer is one of the most commonly diagnosed cancers of the female reproductive system. Cervical adenocarcinoma, one of the most common subtypes of cervical lesions, is known for its aggressive nature. Treatment for this malignancy often involves chemotherapeutic regimens with harsh negative side effects due to a lack of tumor specificity. As a result, novel treatments for cervical cancer are essential to target cancer cells and reduce the incidence of non-specific toxicities. The present study used the cervical adenocarcinoma line, HeLa, as a model to assess novel chemotherapeutic agents for cervical cancer. Recent studies have shown the effectiveness of a fluoroquinolone antibacterial drug, enoxacin, as an antitumor agent against prostate cancer. Similarly, the green tea polyphenol epigallocatechin-gallate (EGCG) has shown to be an effective antitumor and synergistic agent with common chemotherapeutics. Here, we detail the effectiveness of both enoxacin and EGCG as antitumoral agents against HeLa cells in culture. Both drugs were effective in decreasing cell viability and increasing programmed cell death. In conclusion, our findings suggest that both enoxacin and EGCG

are effective at inhibiting the growth of cervical cancer cells in vitro and their potential for use in therapeutic regiments should be further explored and considered.

Second Place Winner of the District II Brooks Award

Bowden, Anna; Lori Tolley-Jordan. Comparing the habitat use of parasitized and non-parasitized*Elimia godwini* (Gastropoda: Pleuroceridae) in a spring-fed stream, Alabama

In some snail species, behavioral alterations caused by parasite infection can lead to differential habitat use between infected and non-infected snails. In this study, differences in habitat use, if any, between infected and non-infected *Elimia godwini*, a Calhoun County, AL endemic freshwater snail were evaluated. In November 2016, snails and habitat data were collected from a 50 m reach of spring-fed stream. Using a stratified random sampling design, snails were collected from 20 quadrats ($0.09m^2$) and velocity (m/s), depth (m), substrate type, and distance from edge were recorded for each quadrat. Snails were transported live to the laboratory where they were measured and dissected to examine infection by Trematodes or Cestodes. In all, 150 snails were collected of which 4% were infected with Trematodes and 11% were infected with Cestodes. No significant differences in snail size or habitat use were found among non-infected snails of snails infected with Trematodes or Cestodes. Although these results suggest that infected and non-infected snails do not differ in habitat use, habitat heterogeneity in this stream was low. Thus, further research is necessary to determine if habitat use differs between infected non-infected *E. godwini* in other streams.

Third Place Winner of the District II Brooks Award

Song, Brian. Mu Theta Chapter, Belmont University. Expansion on the Nematode Scent Detection Test: Evaluating *C. elegans* Attraction to Non-Small Cell Lung Cancer

Caenorhabditis elegans (*C. elegans)* have shown positive chemotaxis towards cancer cell secretions. By applying this behavior clinically, a cancer screening system has been devised and has shown effectiveness for breast, gastric, and colorectal cancers. Prior research has shown that the nematode is also attracted to cervical cancer, specifically HeLa cells. It has not been assessed whether the screening system would be useful for lung cancer. The objective of this project is to evaluate if *C. elegans* displays attraction to A549 cells, a cell line derived from non-small cell lung cancer, when WI-38 (normal human lung fibroblast tissue) is used as a control. It has been observed previously that dilutions to the millionth and ten millionth have garnered positive chemotaxis. Results have shown positive and negative chemotaxis regarding specific dilutions of conditioned A549 medium with fresh medium as the control, and negative chemotaxis with all dilutions of WI-38 with the aforementioned control. With A549 confirmed as the positive control and WI-38 as the negative control, a choice assay was carried out between the two. The attractant used was A549 medium and the control was used WI-38 medium. Results showed positive chemotaxis to the millionth and ten millionth dilutions of used media.

Honorable Mention Winner of the District II Brooks Award

Noel, Gary, Mu Theta, Oral, 2017. The Effects of Fertilizer on Decomposition of Native and Invasive Exotic Plant Species in a Temperate Deciduous Forest

Human activities introduce potentially harmful chemicals into the natural environment, but the introduction of natural elements, such as nitrogen, may be equally detrimental. This study examined the effects of nitrogenous fertilizer on decomposition of leaves from native and exotic plant species. The effects of canopy cover type were also considered. Leaves of native (*Acer saccharum*) and exotic (*Lonicera maackii*) species were placed in leaf

litterbags. Half of the bags included fertilizer, while the other half had only leaves. Bags were weighed and deposited onto the forest floor; one litterbag was removed every three weeks for six months and reweighed to determine mass lost. Both *L. maackii* and *A. saccharum* decomposed more rapidly in the presence of added nitrogen, with *L. maackii* showing statistically significant differences in decomposition. Additionally, *L. maackii* decomposed quicker than *A. saccharum* overall. These results suggest that the presence of additional nitrogen can exacerbate the role that exotic species have on decomposition and nutrient cycling.

District II Brooks Award winners (left to right): Anna Margaret McDonnell , Anna Bowden (not pictured), Brian Song, Gary Noel

DISTRICT II BROOKS AWARD SESSION--OTHERS

Tara Burke, Lori Tolley-Jordan, Jessica Wooten. Department of Biology, Jacksonville State University, Jacksonville, AL. Department of Biology, Centre College, Danville, KY. A survey of freshwater snails and their parasites in Wheeler National Wildlife Park, Alabama

Alabama is known as a global hotspot for freshwater snails, and many serve as the primary host for larval production of trematode flatworms. A single species of snail can serve as the host to many different parasites; therefore, it is possible that there is also a vast amount of diversity of trematode parasites in Alabama. Yet, reports of these parasites are rare, due to the fact that trematode identification is difficult as comprehensive taxonomic keys are rare. Therefore, the use of molecular markers to identify worms and their relationships with snail hosts is the best way to address biodiversity within trematode species. DNA was extracted from trematodes living in freshwater snails collected from the Tennessee River in the Wheeler National Wildlife Refuge in Decatur, AL. Using sequenced 18s rDNA, a GenBank BLAST search was used to match the gene sequences of trematodes collected from our samples against published sequences. GenBank produced identifications with up to 99% sequence matches. Published snail-parasite literature was used to compare our snail host data and geographic occurrence. These results show that snails in our study are often not reported as hosts in the literature and only limited information is available on geographic ranges for parasites.

Littrell, Breanna, University of North Alabama.

Bacterial antibiotic resistance is problematic and has the potential to become life threatening to some individuals, especially those who are immunocompromised. Bacteria can acquire resistance to antibiotics by conjugation (transfer of DNA by cell to cell contact), mutation, or transformation (uptake of DNA from the environment). The transfer of drug resistance between hospital pathogens has led to the increase of multidrug resistant bacterial strains which further complicates treatment. The purpose of this project will be to study gene transfer for the TEM-1 and the CTX-M genes and determine the mode of transmission; either conjugation by plasmid transfer, or transformation by uptake of DNA from the environment. The purpose of this study is to determine the ability of a non-resistant bacterial species to develop antibiotic resistance under selective pressure of an antibiotic. A bacterium that does not show resistance to β-lactams or cephalosporins will be incubated with live or heat killed bacteria that show resistance to antibiotics of these classes. The non-resistant bacteria will be monitored for the development of antibiotic resistance by PCR detection of the TEM-1 and CTX-M genes and Kirby Bauer testing.

Patel Harsh, Elisha Okyere, Dr. Joseph Mester, Dr. Kristi Haik, Dr. David Thompson. Mu Iota, Northern Kentucky University. Examining potential environmental and genetic factors associated with chronic kidney disease of unknown etiology in rural farmers of Sri Lanka

Farmers in rural Sri Lanka are suffering from chronic kidney disease of unknown etiology (CKDu) thought to be caused by various factors including waterborne metals, herbicides, and genetic mutations. Glyphosate has been linked to CKDu because of its potential metal-chelating activity and increasing bioaccumulation of toxic metals in the body. Examples of potential toxicants include well-documented nephrotoxic metals cadmium (Cd) and lead (Pb), and the metalloid arsenic (As). Elemental analyses indicated that Cr, Ni, Pb, Se, Ti, & Zn are significantly elevated in the urine of CKDu vs. healthy individuals. Results also indicated that glyphosate is present in nearly all urine samples, while not significantly different. Interestingly the same elements as indicated above were present in water and rice in varying concentrations. To discern any potential for genetic mutation to be implicated in CKDu, DNA was extracted from saliva samples collected in four Sri Lankan villages. The DNA was evaluated for quality via gel electrophoresis and PCR. The samples were then subjected to microarray analysis using the Illumina Infinium Multi-Ethnic EUR/EAS/SAS BeadChip, which contains nearly 1.5 million human single nucleotide polymorphisms (SNPs). DNA sequence comparisons were then made between healthy and CKDu individuals.

Anderson, Aaron. Bonny Millimaki. Kappa Delta Alpha, Lipscomb University. Just How Time Sensitive are Genes Related to Neurological Development in Early Zebrafish Growth

Our lab has been investigating the role of the enzyme Topoisomerase 2 beta (Top2b) in early neurological development using *Danio rerio* as a model system. Previous studies in our lab have shown that inhibition of Top2b with the chemical inhibitor Hu331 from 12 to 24 hours post fertilization (hpf) impacts axon guidance but not neural differentiation. In contrast, I observed that exposing embryos to Hu331 two hours sooner, from 10 to 24 hpf, results in greater axon disorganization and some examples of neural differentiation defects. This is consistent with the time specific nature of neural development. This study has helped us to better understand the role Top2b plays in neural development and has helped focus our efforts to elucidate the mechanism by which Top2b, a well characterized DNA repair molecule, functions to specifically influence embryonic development.

Adams Amy L., Elizabeth A. Klar, and Michael G. Newbrey. Mu Omicron, Columbus State University. Seasonal Variability of Female Sex Cells in Gonads of Male Largemouth Bass (*Micropterus salmoides*) from Chattahoochee River System, Georgia

Intersex, the occurrence of oocytes in male testes, has been studied among many fish species worldwide, but seasonal variability is nearly unknown. Intersex was previously documented in Largemouth bass, a top tier predator and popular sport fish, of the Chattahoochee River. We hypothesized that Largemouth bass exhibit seasonal variability in two tributaries of the Chattahoochee River. Fish from the polluted, highly altered, urban Lindsey Creek and the pristine, rural Heiferhorn Creek in Columbus, GA were collected using backpack electrofishers and gonadal tissues sampled. Male gonadal tissues were prepared using histological techniques and stained with hematoxylin and eosin. Multiple testis sections were taken and examined microscopically for incidence of oocytes. No oocytes were visualized (n = 6); therefore, no relationship between seasonal variance and intersex prevalence could be determined. Intersex in fishes has been linked to endocrine-disrupting chemicals found in agricultural runoff and waste-water effluent, which in the urban creek may not have been major contaminants. Since intersex has previously been found in the Chattahoochee River, we plan to add samples from various locations on the river. The source of the endocrine disrupting chemicals in the river may be from upstream of Columbus, GA rather than from the two creeks examined.

Belt Jeramy M., Elizabeth A. Klar, and Michael G. Newbrey. Mu Omicron, Columbus State University. Chronological age and the occurrence of intersex within Largemouth bass (*Micropterus salmoides*), of the lower Chattahoochee River watershed, Georgia.

Previous work has shown intersex to be present in Largemouth bass (*Micropterus salmoides*) of the Chattahoochee River, however, the potential relationship between the age of Largemouth bass and prevalence of intersex is unknown. Intersex is a phenomenon where an organism of one sex shows characteristics of the opposing sex within its gonadal tissue. We hypothesize there is a positive relationship between age and the prevalence of female oocytes because the longer fish are exposed to endocrine disrupting compounds the more likely they might exhibit intersex. Male Largemouth bass were sampled from Lindsey Creek, a tributary of the Chattahoochee River. Lindsey Creek is a highly-altered channel with a poor riparian area that is subjected to industrial, commercial, and urban runoff. Electrofishing was used to collect fish, and gonadal tissue was removed, thin sectioned, stained, and examined for female oocytes. Age was determined from otoliths. Water quality was assessed at each sampling locality. Of 21 Largemouth bass, six males were collected and none of them had female oocytes within their gonadal tissue. The oldest bass was five years old. Despite Lindsey Creek's appearance, water quality data has thus far shown that chemical levels have been in the acceptable range for human consumption.

Nathan Spaulding[1,], Shivakumar Devaiah [1,3], Cecilia McIntosh.[1,2] [1]Department of Biological Sciences and [2]School of Graduate Studies, East Tennessee State University, Johnson City, TN 37614, USA. [3]Biostrategies-LC, Arkansas Biosciences Institute, State University, AR 72467. Determination of the Substrate Specificity of the Mutant D344P of *Citrus paradisi* Flavonol Specific 3-O-Glucosyltransferase.

Plants produce a vast array of secondary metabolites. Flavonoids are important metabolites known to aid in processes such as plant reproduction, UV defense, and pigmentation and are known to have anti-oxidant, anti-cancer, and anti-inflammatory properties when consumed by humans. In nature, flavonoids are often found in glucosylated form. Glucosyltrasnferases (GT) catalyze these sugar additions. *Citrus paradisi* contains a glucosyltransferase that is specific to the 3-O position of flavonols (Cp3-O-GT). To help understand the reactions it catalyzes, Cp3-O-GT structure was

modeled against an anthocyanidin/flavonol GT found in *Vitis vinifera* to identify candidate amino acids for mutations. The mutant D344P was constructed using site-directed mutagenesis to replace an aspartate with a proline as based off of the sequence comparison of the original enzymes. Biochemically characterizing the mutant D344P protein will determine whether the mutation has an effect on the substrate specificity of Cp3-O-GT. An initial quick-screening assay using radioactive UDP-glucose as a sugar donor suggested possible expansion of substrate acceptance. Confirming time course assays do not support the expansion of substrate specificity and show that D344P protein has decreased activity with flavonols as compared to wild type Cp3-O-GT, and models suggest that a change in protein conformation caused these results

DISTRICT I JOHNSON AWARD SESSION--WINNERS

First Place Winner of the District I Johnson Award

DeVasure, Brittany. Dakota Goad, Darren Seals, Maryam Ahmed. Beta Psi, Appalachian State University. Oncolytic Vesicular Stomatitis Virus Alters Cancer Cell Invasion Mechanisms

Vesicular stomatitis virus (VSV) has been shown to effectively kill cancer cells while exhibiting low virulence in vivo. However, there is limited information on how VSV affects the migratory and invasive mechanisms of cancer cells. Cancer cell invasion depends on the formation of actin-rich structures called invadopodia, which are responsible for the degradation of the extracellular matrix (ECM). We hypothesize that VSV alters invadopodia structures in cancer cells, subsequently inhibiting their migratory and invasive behavior. Our results show that both wild-type and matix (M) protein mutants of VSV decrease the ability of cancer cells to degrade through the ECM. In addition, scratch assay studies show that both viruses suppress the migratory capacity of cancer cells. Invadopodia formation in infected cancer cell lines at early times post-infection is also suppressed. These results suggest that VSV inhibits the proteolytic degradation of the ECM, resulting in a decreased ability of cancer cells to migrate. Ongoing studies will further determine the mechanisms by which VSV alters oncogenic invasion.

Second Place Winner of the District I Johnson Award

Moreno, Elias, Leslie Pryor McIntosh. Techniques in characterizing the morphology of osteocyte cell bodies and their dendrites

Movement of interstitial fluid resulting from mechanical stimuli throughout un-mineralized cavities (lacunae and canaliculi) occupied by osteocytes and their cell processes (dendrites) after matrix mineralization enables osteocytes to be coordinators of bone remodeling. Little attention has been given to bone variations at the cellular level influencing bone adaptation; hence, analysis of cell body size and shape as well as diameter, dendritic surface area, volume, length and other properties are key factors in addressing why species and location-specific differences exist systemically. Analyzing such properties is dependent on innovative techniques that offer visualization of 3-dimensional osteocytic network without decalcification of the surrounding mineral. In one such technique, bone samples are obtained from human cadaveric mandibular condyles, dehydrated, stained with fluorescein isothiocyanate isomer 1 (FITC), and embedded in methyl methacrylate. Three-dimensional images are obtained using confocal microscopy and Imaris software is used to characterize the stained osteocytes' cell body surface area, volume, shape and dendritic number while μCT analysis of samples provides results of bone volume fraction, material density, and apparent density. This procedure can yield

significant data that will aid in interpreting the causes of bone degeneration and disease as well as aid in anthropological comparisons of craniofacial adaptations.

Third Place Winner of the District I Johnson Award

Patel, Aayushi. Tau Gamma. East Carolina University. Affect of Dominance Hierarchy Formation on Neurotransmitter Gene Expression in the Crayfish *Procambarus clarkia*

Honorable Mention Winner of the District I Johnson Award

Green, Amanda, Tanner Watkins, Dr. Heather Cathcart. Abraham Baldwin Agricultural College, Tau Delta Kappa Chapter. Nose Goes: Alzheimer's Olfaction and *C. elegans* Chemotaxis

The mutant strain ynls-79 of *C. elegans,* overexpresses the APL-1 protein, which impacts chemotaxis in the adult nematodes (Ewald et al., 2012; Hornsten et al., 2007). This protein is comparable to the β-amyloid peptide that accumulates forming the tangles and plaques within neurons of an Alzheimer patient's brain (Ewald et al., 2012; Kjelvik et al., 2014). Alzheimer's patients are known to experience a loss of sense of smell in early stages of the disease. A common tool used in diagnosed dementia patients is a standard smell test (Kjelvik et al., 2014; Kjelvik et al., 2007; Roberts et al., 2016; Schofield et al., 2012; Suzuki et al., 2004; Tabert et al., 2005). Our research explores the possibility that a mutant strain of *C. elegans,* ynls79, reflects this as a chemosensory deficiency when exposed to flavors known to be problematic to dementia patients. This project explores *C. elegans* chemotaxis using common scents from the human smell test. It is predicted that the mutant strain will not be able to sense the odorant and will either be confused or drawn to the control in the chemosensory assay. This research may provide information useful for detecting Alzheimer's disease earlier.

Honorable Mention Winner of the District I Johnson Award

Shirley Andrew (Kendall Maze, Richard Settele, David Turner, Logan Young, and Nancy Eufemia Dalman). Psi Roh, Univeristy of North Georgia. '"Abundance and diversity of meiofauna on Nannygoat Beach, Sapelo Island, Georgia

District I Johnson Award Winners (left to right): Brittany DeVasure, Elias Moreno, Aayushi Patel, Amanda Green, Andrew Shirley

DISTRICT I JOHNSON AWARD SESSION--OTHERS

Venugopal, Natasha, Shelby Howard, Bhagelu Achyut, Ali Arbab, and Jennifer W. Bradford. Kappa Kappa, Augusta University. *Impact of myeloid cell NF-κB signaling on glioblastoma growth*.

Cancer consists of malignant tumor cells as well as supporting, non-cancerous cells, like immune cells, which can lead to tumor progression through promotion of tumor inflammation, angiogenesis, invasion, and metastasis. Canonical nuclear factor-kappaB (NF-κB) pathway activity is very important in normal immune function and aberrant NF-κB activity is associated with cancer. As myeloid cell NF-κB signaling may be important in promoting cancers, we have been utilizing the $p65^{fl/fl}$/LysMCre transgenic animal model, which lacks p65 protein in cells of the myeloid lineage, to study the impact of myeloid cell derived NF-κB signaling in glioblastoma (GBM), an extremely aggressive brain cancer. This transgenic model has a very efficient deletion of p65 protein and drastically reduced NF-κB signaling in bone marrow derived macrophages (BMDMs), but brain residing microglia do not have significantly lower p65 levels as compared to control microglia. Even with this finding, $p65^{fl/fl}$/LysMCre mice implanted with syngeneic GBM cells have significantly reduced GBM tumor burden than control mice, as measured by magnetic resonance imaging. These data demonstrate the importance of myeloid cell NF-κB signaling on GBM formation even when brain microglia maintain close to normal levels of p65. This work indicates the potential benefits of targeting the myeloid specific NF-κB pathway in GBM patients.

Yang He Wesleyan College, Sigma Lambda. The Influence of Zinc on Human Prostate Smooth Muscle Cell Proliferation

Abstract: Zinc plays an important role in the human body and is an essential element in the cell fluid of the prostate, with an ionic concentration that is 500–1,000 times higher than the concentration in blood. The work of Bozym and her colleagues suggested that altered transport of zinc may be associated with the development of prostate cancer, but few studies have examined the dose-response characteristics of zinc in normal, non-epithelial cells of the prostate. Understanding the zinc tolerance of non-epithelial prostatic cells is important, as dietary supplementation with zinc has been proposed as a potential treatment for prostate cancer. The current study examines the role of zinc in influencing the proliferation of primary cultures of prostate smooth muscle cells. Early passage cells were exposed to $ZnCl_2$ treatments ranging from 50mM to 300mM using both short-term (3 day) and long-term (7 day) exposure periods. The data indicate that cell survival in treatment conditions above 150mM $ZnCl_2$ is severely compromised and that treatment with 300mM $ZnCl_2$ results in complete cell death.

Fujii, Chika; Littleton, Sejiro; Kasapi, Melpi; Sarafova, Sophia. Tau Omega, Davidson College. Modeling CD4 Expression with Short Lived EGFP

The surface glycoprotein CD4 plays an important role in regulating the CD4 T cell development. While previous research has identified the promoter, the proximal enhancer, and the silencer, these elements still do not fully describe the mechanism governing the dynamics of *Cd4* expression in developing thymocytes. The Sarafova Lab has identified a regulatory element, termed the Novel Cis Element (NCE). Results of *in vitro* experiments show that the NCE is most active at the intermediate stage of CD4 T cell development. To better understand the kinetics of *Cd4* expression over time, we developed a transgenic mouse model that expresses an enhanced GFP that acts as a CD4 reporter. The EGFP also has a shortened half-life of two hours, which allows for detection of small differences in the EGFP expression at different developmental stages. Through comparing the expression levels of the EGFP between mice with or without the NCE, we expect to see a

lowered EGFP intensity in the DNCE mouse strain. The levels of EGFP were measured by flow cytometer analysis and directly visualizing the GFP protein through immunohistochemistry analysis.

Reidell, Stephanie. Psi Chi, Virginia Wesleyan College. The effects of molecular weight on the antimicrobial and wound healing properties of chitosan in *Carassius auratus*

Due to increasing microbial resistance, blood loss and the development of infections resulting from traumatic injuries and surgical procedures are a continuous concern despite decades of advances in antiseptic technology. In recent years, a plethora of research has been conducted pertaining to the effect of molecular weight on the properties of the naturally occurring polymer chitosan in biomedical applications. In this study, the effect of the polymer's molecular weight on antimicrobial and wound healing properties were explored. Biological assays were conducted to determine the antibacterial properties of high and low molecular weight chitosan against gram-positive *Bacillus subtilis,* and gram-negative *Escherichia coli.* Disk diffusion and broth dilution methods were used to determine inhibition properties. A sample of 40 goldfish, *Carassius auratus,* with $2mm^2$ wounds were treated in baths of commercial fish antibiotic Melafix, 50 kDa chitosan, or 310 kDa chitosan solutions and evaluated every third day for 21 days. Analyses were conducted using wound area and morphological changes to determine healing rate. High molecular weight, 310 kDa, chitosan had a stronger antimicrobial effect against both bacterial strains.

Nguyen, Lisa and Gonsalves-Jackson, D. Psi Chi, Virginia Wesleyan College. The release of zooxanthellae in *Aiptasia pallida* due to environmental stress

The sea anemone *Aiptasia pallida* is affected by global warming primarily through the loss of their symbiotic zooxanthellae. This is highly detrimental as most of the energy required for basic functions originates from the photosynthetic zooxanthellae, which is highly sensitive to environmental changes. The objective of this study was to determine zooxanthellae expelled by the sea anemone due to varying water temperatures and levels of light exposure. Temperature was tested by setting the water temperature to 20°C, 25°C, and 30°C. Light exposure was tested by exposing the anemones to 18h light/6h dark, 6h light/18h dark, and 12h light/12h dark cycles. Animals were exposed to treatments for 24 hours. After 24 hours, the anemones were incubated for 24 hours at 23°C, and homogenized. The amount of zooxanthellae released and retained were counted using a hemocytometer to determine the percentage of expelled zooxanthellae in the different treatments.

Smith, Kelsey. Eta Iota. Emory & Henry College. Comparison of BT versus Conventional Field Corn in Production Yield

GMOs have been a topic of controversy in society with concerns of environmental impacts as well as consumer health. Bacillus thuringiensis (Bt) corn is proposed to increase yield by decreasing insect damage. This project sought to compare yield between Bt and Conventional field corn. This research took place during the summer of 2016 in Sheldon, ND. Data was collected for yield at the end of harvest season (Nov, 2016) with a Case IH 7010 combine. The results from this experiment, surprisingly, found there was little difference between conventional and Bt field corn in yield. The next step in the research is to run PCR to detect if cross pollination with Bt affected the conventional corn.

Dean, Lindsey. Eta Iota, Emory & Henry College. Quantifying *Sepallata* Gene Expression in Column; Anther Cap, Viscidium, and Pollinium; Platform, and Lip and Labellum of *Phalaenopsis*

Floral organ development as well as floral morphology is important for attracting pollinators which aid in seed and pollen dispersal. The ABCDE model shows that *SEPALLATA* genes are MADS-box, E-class genes that are expressed in flowering plants which lead to the development of floral organs and establish floral organ identity This study was conducted in order to measure *SEPALLATA* concentrations in the following floral organs of *Phalaenopsis:* column; anther cap, viscidium, and pollinium; platform, and lip and labellum. RNA was isolated using an RNeasy kit and then converted into cDNA. The cDNA was used in RT-PCR in order to compare expression levels of *SEP2* and *SEP3* in floral organs of a mature flower and buds. This research is important for further understanding the subfunctionalization of *SEPALLATA* genes in differing organs.

Kirk, Erin. Eta Iota. Emory & Henry College. Phylogeography of Montane Salamanders in Southwest Virginia: A Mitochondrial Analysis-Part One: Non-Invasive DNA Sampling

Researchers should use the least destructive and minimally invasive methods when sampling threatened or endangered species. Genetic sampling utilizing epithelial mucosal swabs has been demonstrated to yield sufficient quantities of skin cells for DNA analysis, comparable to the conventional, but more invasive and potentially harmful, toe or tail clipping methods. The goal of this portion of our study was to demonstrate the effectiveness of this non-invasive DNA sampling technique and its utility in conservation genetic studies. A total of 66 salamanders were hand-caught and sampled for DNA: (37) from Whitetop Mountain; (17) from Elk Garden; 12 from Mt. Rogers. For our three primary target species, a total of (21) *P. cinereus,* (30) *P. montanus*, (7) *P. welleri*, and (8) unidentified juveniles were sampled. Genomic DNA extractions were quantified utilizing a Nanodrop 2000 Spectrophotometer, followed by PCR amplification of an 800 bp fragment of Cytochrome B. PCR products were visualized on a 1% TBE gel. Results indicated swab samples yielded sufficient DNA (25-400 ng/ul) for downstream phylogenetic and phylogeographic analysis at comparable levels to convention tail/toe clippings.

Gearhart, Brandon. Eta Iota, Emory & Henry College. Epithelial Mucosal Swabbing of Frogs (Ranidae) as an Indicator of Bovine Fecal Coliform Contamination of Aquatic Habitats in Southwest Virginia

Epithelial mucosal membranes of *Lithobates catesbeianus* (American Bullfrog) and *L. clamitans* (Northern Green Frog) were swab sampled for fecal coliform (FC) bacteria presence. Frogs from habitats shared with *Bos taurus* (domesticated cattle) as well as frogs from cattle-exclusion habitats were sampled and compared. We hypothesized that frogs coexisting with domesticated cattle would demonstrate a higher prevalence of FC than frogs in enclosed, cattle-exclusion habitats. Northern Green Frogs were 3 to 4 times more prevalent than American Bullfrogs in this particular sampling area of Floyd County, Virginia. Ninety-four percent of the 58 frogs sampled had at least one species of FC on their epithelial mucosa in habitats shared with cattle, compared to 80 percent of the 15 frogs sampled in cattle exclusion habitats. Water samples were membrane filtered to confirm the presence of fecal coliforms in the shared habitats. Eighty-seven percent of the 56 Northern Green Frogs and 82% of the 17 American Bullfrogs sampled had at least one species of fecal coliform present in their epithelial mucosa, thus there was no significant difference between species. Frog mucosa is often thought to have antimicrobial properties, but based on the results of this study further research into this topic may be warranted.

Bigham, Zahna (Schroeder, Wanda). Sigma Lambda, Wesleyan College. Analysis of Notch1 Expression in Cervical Carcinoma Cell Lines

Cervical cancer is one of the leading causes of cancer mortality in women. In recent years, numerous advances have been achieved in the early detection and therapeutic

treatments provided to patients suffering from cervical cancer, however, many of the underlying molecular mechanisms of cervical cell transformation have not been elucidated. The Notch signaling pathway regulates a multitude of cellular activities including cell-fate specification and stem-cell maintenance. Notch1 signaling has been reported to be up-regulated in numerous human malignancies. In tumorigenesis, Notch1 signaling has shown to be oncogenic. Previous studies have demonstrated that dysregulated overexpression of Notch1 protein occurs in breast cancer, but a possible role of Notch1 in the development of cervical carcinoma has not been analyzed. In the current study, four cervical carcinoma cell lines at different grades, ATCC HTB-33, ATCC HTB-32, and ATCC HTB-35, and ATCC HTB-31, were utilized to analyze the expression of Notch1 protein. Immunohistochemistry employing a monoclonal mouse anti-human Notch1 antibody was utilized to determine the expression of Notch1 in each of the cell lines studied. Determining the expression of Notch1 in cervical carcinoma cell lines will add to the growing body of knowledge regarding the role of Notch1 protein in the development of cancer.

Mohanty, Monica. Sigma Lambda, Wesleyan College. The Expression of GATA-3 in Cervical Carcinoma

The American Cancer Society estimates that slightly over 4,000 women will die of cervical cancer this year. Recent studies, utilizing immunohistochemistry, have identified GATA-3 as a sensitive marker for urothelial carcinoma , ductal breast carcinoma, and transitional proliferations of the gynecological tract in human tissues. GATA-3 has been suggested to be useful in the evaluation of mammary and urothelial carcinomas, but its distribution in normal and neoplastic tissues is not fully understood. GATA-3 is a transcription factor, and is an important regulator of T-cell development. It regulates luminal epithelial cell differentiation in the mammary gland, and it has been suggested that GATA-3 is regulated in CD4+ T cells at a transcriptional level through the IL-4 receptor, as well as translationally through T cell receptor signaling. Given the fundamental role of GATA-3 in maintaining the differentiation and adhesion of the luminal epithelial cell, it was hypothesized that GATA-3 could be involved in cervical cancer. Studies also indicated that GATA-3, in association with the estrogen receptor (ER), is likely to regulate genes critical to hormone-responsive breast cancers. In the current study, four cervical cancer cell lines at different stages, HTB-31, HTB-33 and HTB-35, and one breast cancer cell line CRL-1500, were used to study the possible role of GATA-3 expression in cervical carcinomas utilizing immunohistochemistry with an anti-human GATA-3 mouse monoclonal antibody. Determining the expression of GATA-3 in cervical carcinomas at different stages should add to our understanding of the possible role of GATA-3 in carcinoma development.

Boyd, Emily; Richard Davis; Theodore Webster; Brian Scully; Timothy Brenneman. Effect of root-knot nematode parasitism on yield and sugar content of sugar beet in Georgia

Sugar beet (*Beta vulgaris*) could be grown in the winter in Georgia as a new biofuel crop. Sugar beet roots are severely galled by the southern root-knot nematode (RKN; *Meloidogyne incognita*), but RKN does not damage plants at low soil temperatures during the coldest part of the winter. We conducted a field study for two growing seasons to determine the effect of RKN on yield and sugar content of sugar beet grown as a winter crop in Georgia. The study used one RKN-resistant and three susceptible genotypes planted in the fall each year in plots treated or not treated with the nematicidal fumigant 1,3-dichloropropene and harvested the following spring. Fumigation reduced root galling and increased yield in both years. Fumigation increased the yield of all genotypes in 2015 but increased only the yield of one susceptible genotype in 2016. In both years, fumigation affected yield of the resistant genotype less than that of the susceptible genotypes. Sugar content, measured as Brix, was increased by fumigation in 2015 but not 2016. We

conclude that sugar beet grown as a winter crop in Georgia can suffer significant yield losses from RKN parasitism, which may result in reduced sugar content in some years.

Leberman, Jonathan; Carrie, Swinney; G. John, Lugthart; Chris, Manis. Beta Chi Nu, Dalton State College. A Study ofaAn Aquatic Turtle Assemblage in a Northwest Georgia Lake and Wetland Prior to Restoration

A five-year study was conducted to characterize the aquatic turtle community within an urban park in Dalton, Georgia prior to a pending habitat restoration. Hoop traps were used to collect turtles from Threadmill Lake, a ~1.01 ha subdivided lake and an adjoining ~ 0.70 ha wetland. Sampling was conducted during two-week periods in June 2012, July 2013, June 2014, June 2015, and July 2016. Morphometric data were recorded, and sex was determined for adults. Each turtle was uniquely marked and released immediately after processing. A total of 892 turtles were captured representing four families and six species. Catch per unit effort ranged from 0.86 turtles/trap/day (2015) to 2.39 turtles/trap/day (2016). Population estimates for the five most abundant species were as follows: *Sternotherus odoratus (*846 ± 95), *Trachemys scripta* (413 ± 51), *Chelydra serpentina* (395 ± 64), *Pseudemys concinna (384* ± 65), *and Chrysemys picta (*140 ± 28). These "before" data will be useful in assessing effects of upcoming stabilization and revegetation of the shoreline on the turtle community.

Ramos, D. Annalia; B. Dillion, Cantrell; Marina, Smitherman. Beta Chi Nu, Dalton State College. Antimicrobial Properties of Venom from Native Snakes of Southeastern United States

The antibiotic resistance crisis is endangering the efficacy of antibiotics and threating the lives of individuals. Antibiotics are designed to combat numerous bacteria by targeting their cellular machinery, however, improper and repeated utilization of prescribed antibiotics will lead to antibiotic resistance. In this case, an antibiotic is considered a selective pressure which leads to an alteration of the bacteria's fitness. The demand for new antibacterial agents is increasing and their development must occur alongside the evolution of pathogens. Snake venom has been identified as a possible antimicrobial treatment because of its rich source in differentiating compounds. In this investigation, whole venoms from *Agkistrodon contortrix mokasen, A. c. contortrix, A. piscivorus conanti, Crotalus horridus,* and *C. adamanteus* were utilized to test antibacterial activity against *Staphylococcus aureus, S. epidermidis, Aromonas hydrophila, and Escherichia coli*. The venoms yielded zone of inhibition by disk diffusion demonstrating effective antibacterial activity against strains. Separation of proteins from the venoms could lead to the isolation of antibacterial enzymes and a potential treatment for antibiotic resistant bacterial strains.

Bell, Jessica. Tau Delta Kappa, Abraham Baldwin Agricultural College. Analysis of Pesticide Residues in Georgia's Groundwater.

Water is a vital resource for all species on Earth. With so much demand on this vital resource, it's imperative that the supply available for Georgia is monitored to ensure its quality is maintained for agricultural production and for the drinking water supply. This project is a continuation of a water survey began in 2015. This project evaluated the amount of 29 agriculturally important pesticides that could be detected within nine different raw groundwater systems across the state. During the initial survey, 127 samples were analyzed using the EPA Method 525.5 via gas and liquid chromatography. The current study has continued to monitor raw groundwater samples for the same 29 agriculturally important pesticides at different locations than the 2015 study to determine if the trend of non-detect will continue.

Ramspeck, Kaitlin, Kaitlin Pepper, Daniel Brown, and Mark Davis. Psi Rho Chapter, University of North Georgia. Worker Subcaste Behavior in Neotropical Leafcutter Ants.

Members of the smallest worker subcaste (workers called minims) in neotropical leafcutter ants (*Atta sp.*) frequently hitchhike (ride) on cut leaf fragments transported to the ant nest by foraging workers. Hitchhikers protect foragers against phorid fly parasitoids. They also remove fungal contaminants from leaf fragments before the fragments are processed in the nest and then provisioned to symbiotic fungi that supply the ants with food. Recent research has shown that sap obtention (nutrient acquisition) by minims from cut leaf fragments is more important than defense in some leafcutter species. We observed hitchhiking minims in 12 foraging columns of *Atta cephalotes* in montane cloud forest near Monteverde, Costa Rica. The behavior of minims (n = 153 ants) on leaf fragments during 30 s observation intervals was categorized as defense or nutrient acquisition. The most frequently observed behavior was consistent with defense, primarily defense against phorids. Behavior consistent with sap obtention was the least frequently observed. Our results indicate that defense is the primary factor explaining hitchhiking behavior in cloud forest *A. cephalotes* minims but hitchhikers occasionally feed on sap at the margin of cut leaf fragments.

Garrick, Shannon[1]; Chrystal Swinger[2], Carmony Hartwig[1], Bruce Harrison.[1] [1]Catawba College [2]Cabarrus Health Alliance. Comparative Study of Mosquito Biodiversity in Cabarrus County, North Carolina

Understanding mosquito biology and species-specific disease vector status is critical for successful control efforts. Abundant vector populations capable of carrying a wide variety of pathogens may be directly related to the number and type of breeding sites available. Many natural habitats support mosquito reproduction (e.g. treeholes and temporary rain pools), while human activity often supplies additional artificial breeding sites for some of our most important vector species (e.g. abandoned tires and open containers). To determine the potential effect of human-influenced breeding sites versus more natural areas we chose to sample several rural, suburban, and urban areas within Cabarrus County. To investigate the abundance and diversity of mosquito populations between select locations we used standard CDC and BG Sentinel traps in Cabarrus County from 2014 - 2016. Differences in overall mosquito diversity and abundance between the habitat types were analyzed using Shannon's Biodiversity Index. For comparison, we discuss our findings in the context of the mosquito abundance and diversity in the nearby Fred Stanback Jr. Ecological Preserve (FSJEP) in Rowan County. Our results highlight the importance of natural areas such as ecological preserves for the study of mosquito biology, habitat selection, vector potential and species competition.

Jones, Kara. Nu Upsilon, Bridgewater College. The role of starvation and cellular differentiation in polyhydroxybutyrate depolymerase synthesis in *Streptomyces* sp. 5A.

Streptomycetes are filamentous bacteria which sequentially form substrate mycelia, aerial mycelia and spores during growth. Polyhydroxybutyrate (PHB) is a plastic-like storage polymer produced by certain bacteria and degraded by other bacteria using extracellular PHB depolymerases. PHB depolymerase in *Streptomyces* sp. 5A is synthesized during growth on PHB but not glucose. Previous research suggests that PHB depolymerase synthesis may initially be triggered by developmental cues and/or carbon starvation, and not necessarily by the presence of PHB. Because streptomycetes produce glycogen reserves during nutrient starvation and morphological transitions, glycogen can serve as a proxy indicator of both conditions. To further investigate regulation of PHB depolymerase synthesis, cell suspensions were incubated with or without PHB. Samples were taken at time intervals, centrifuged, and supernatants assayed for PHB depolymerase activity. Cell pellets were assayed for glycogen content, extractable protein, and phaZ mRNA levels by a reverse transcriptase polymerase chain reaction (RT-PCR) method. Intracellular glycogen content and protein in the presence of PHB spiked between 24-48 hours, the same time that PHB depolymerase activity peaked. No enzyme and minimal glycogen

were produced without PHB present. Results coincide with previous research that PHB depolymerase synthesis is induced by nutrient starvation and/or developmental changes.

Reed, Michelle. Nu Upsilon, Bridgewater College. Identification of Mutations in the Polyhydroxybutyrate Depolymerase gene of Bald Mutants of *Streptomyces* 5A.

The polyhydroxybutyrate (PHB) depolymerase of *Streptomyces* sp. 5A breaks down the biodegradable plastic, PHB, into 3-hydroxybutyrate monomers. The enzyme is synthesized during growth on PHB but not on glucose, suggesting that the promoter region of the PHB depolymerase gene (phaZ) may contain potential binding sites for transcriptional regulators. A previously identified mutant of *Streptomyces* sp. 5A, bld4, is defective in both aerial mycelium production and synthesis of PHB depolymerase, possibly because of mutations in regulatory sites in the phaZ promoter region. To assess this possibility, sections of the promoter region and protein coding region of phaZ in both the wild-type and bld4 mutant strains were amplified using the polymerase chain reaction (PCR) and the amplicons analyzed by agarose gel electrophoresis. Whenever sense PCR primers targeting the 5' end of the phaZ promoter region were used, the bld4 mutant consistently yielded no or incorrectly sized products after PCR, while the wild-type yielded products of the correct size. Results suggested that the binding sites for these sense primers were altered in the phaZ promoter region of the mutant but not the wild type. These results may give future insight into the study of transcriptional control of phaZ.

Johnson, Dominique. Nu Upsilon, Bridgewater College. Adolescent Oxycodone Exposure's Impact on Drug Sensitivity in Adulthood

This study assessed the effects of adolescent oxycodone exposure on sensitivity to cocaine and alcohol in adult mice. The study demonstrated adolescent exposure to oxycodone decreases the sensitivity to both cocaine and alcohol in terms of their impact on motor ability and reward in adulthood. The results suggest that adolescent exposure decreases the subsequent effects of such drugs. This places subjects at a greater risk for substance abuse problems and may be a contributing factor in perpetuation of drug use.

Watkins, Tanner; Amanda Green; Joseph Falcone; Heather Cathcart. Do Antioxidants=Anti-Alzheimer's? Effects of Antioxidants on APL-1 in C. elegans.

The apl-1 gene expresses a protein in *C.* elegans similar to the amyloid precursor protein in humans (Daigle, Li, 1993). The protein is overexpressed in neurons of the nematodes which results in molting issues and motor dysfunction. A mutant strain of *C. elegans*, ynIs-79, is an apl-1 overexpressor developed by Li and colleagues. Hereditary dementia is a common effect of accumulation of abnormal amyloid precursor protein in humans. Antioxidants from *Ginkgo biloba* could help with the detrimental impact of the protein in nematodes and people. Our goal for the project was to separate antioxidants from the whole leaf and to treat the mutant strain of *C. elegans* with each antioxidant to examine their memory of stimulation and habituation. We separated the antioxidants crushing the leaves and soaking them in a 1:1 ratio of 95% ethanol and water for 16 hours. Then we strained the mixture to remove the particulates. The antioxidants were quantified by comparting standards to antioxidants isolated from our extract using paper chromatography. We predict that quercetin will be the most effective at habituating tactile reception the quickest in the apl-1 *C. elegans* mutants.

Zachary Bowens, Dr. Naoma Nelsen and Dr. Al Mina. An Acute study of the Toxic Effects of TiO2 on Daphnia magna

Photo catalytic nanoparticles are composed of materials such as TiO_2 and can range in size from 20 – 300 nm. They also possess photocatalytic properties that are instigated by a certain UV wavelength (325 nm) and afford the TiO_2 its antimicrobial properties. TiO_2

nanoparticles are widely used and can be found in products ranging from cosmetics to decontaminates. TiO_2 nanoparticles are increasing in popularity and availability due to their low cost and antimicrobial properties. These nanoparticles are being used at a prodigiously high rate with little thought about the potential environmental impact they could have. Nano-sized TiO_2 is known to form hydroxyl radicles when catalyzed by light (l < 375nm), which could potentially result in the degradation of organic material and death of aquatic organisms. This study looks to show the effects of 25nm unfiltered nano-sized TIO_2 on the aquatic invertebrate species, *Daphnia magna.* To observe the extent of the damage done to this aquatic organism, stock solutions composed of unfiltered nano-sized TiO_2 and natural spring water at concentrations of 0 mg/L, 50 mg/L, 100 mg/L, 200 mg/L, and 500 mg/L were prepared. Five Daphnia *magna* were placed in 10mL of the respective solutions and were placed under two 15-watt florescent bulbs and were left for 72h while on a 12h light dark cycle. Over the course of four trials, the rate of survival was shown to be 84%, 96%, 96%, and 84% with respect to the first, second, third, and fourth trials. The study found that there is no significant relation to the concentration of unfiltered nano-sized TiO_2 and survival rate of *Daphnia magna.*

Warang, Shamta[1,2] Titilope Ogunleke[1], Danielle Capps[1], Lance A. Durden[2], Sarah Zohdy[3], and Marina E. Eremeeva.[1] Tau Kappa Chapter, Georgia Southern University. Detection of Pathogens and Markers of Permethrin Resistance in Human Lice from Madagascar

Human body lice are vectors of several human pathogens. In contrast, human head lice are only sporadically associated with findings of *B. quintana* and *Acinetobacter*. **Purpose**: Test human head lice collected in Madagascar for louse-borne pathogens and permethrin resistance markers. **Methodology**: Head lice (n=213) were collected from 6 villages. DNA from each louse was extracted and tested using TaqMan assays for *Acinetobacter sp.* and *B. quintana*. End-point PCR was used to amplify a 332-bp fragment of the louse gene incorporating the *kdr*-permetherin resistance biomarker for the T917I mutation, followed by restriction fragment analysis. **Results**: Sixty-five lice tested positive for *B. quintana* DNA (30.3%, 95% CI 24.13-36.47%), ranging from 0% to 92.9% in 6 different sites where lice were collected. DNA of *Acinetobacter sp.,* including *A. baumannii* was detected in 42 of 130 (32.3%, 95% CI 24.26-40.34%) adult lice tested. *Kdr*-mutation was detected in 112 lice (52.5%, 95% CI 45.8-59.2%). **Conclusions:** Detection of the *kdr*-mutation in Malagasy lice indicates the need for broad education regarding proper practices of treatment and management of head lice. Finding *A. baumannii* and *B. quintana* in association with human head lice may lead to greater severity of pediculosis in sensitive individuals.

Leight, Allie. Beta Alpha, Salem College. Gopher Tortoise Distribution at Merritt Island National Wildlife Refuge

The gopher tortoise, *Gopherus polyphemus*, is native to much of the southeastern U.S. (USFWS 2016) and is federally listed as threatened in three states (USFWS 2016). Gopher tortoises are threatened by roads that serve as "ecological traps" that appear beneficial, but lead to vehicle deaths (Morgan *et al.* 2010). Given the dangers posed by roads, locating areas of highest tortoise density and understanding the habitat conditions that attract tortoises to roadsides could significantly decrease mortality. In this study, tortoises along Phillips Parkway at Merritt Island National Wildlife Refuge were marked and their location, shoulder upon which they were found, and time of day was recorded. Tortoise density was calculated for 100m segments of roadway (100 total segments). Density ranged from 0 to 16 within the blocks, with the highest density blocks containing 13, 15 and 16 tortoises respectively. Difference in number of tortoises by side of the road was significant ($p< 0.01$). Habitat characteristics were analyzed for 15 randomly selected 100m road segments to assess their correlation with tortoise density. Average width of road shoulder on the western side of the road was a significant predictor of tortoise abundance ($p>0.05$).

Harman, Maddison. Sigma Psi, Florida Institute of Technology. Protein concentration variations in larval Gobiidae

The Blue Neon Goby (*Elacatinus oceanops*), Tiger Goby (*Elacatinus macrodon*), and Sharknose Goby (*Elacatinus evelynae*) inhabit ranges from Florida to northern South America and throughout the Caribbean. All three of these species are common in the aquarium trade and have been successfully bred and raised in captivity. It is therefore surprising that the published knowledge of these species is minimal. The key to the occupied niches of the gobies could lie in their larval dispersal traits. When the larvae first hatch they have a certain amount of energy that will allow them to survive to settlement, or until they find their first meal. For most fish larvae, proteins are catabolized first. Therefore, the higher the initial protein concentration, the farther the larval fish should be able to travel and survive before settlement. A Pierce BCA Protein Assay Kit was used to discover the frequencies of protein ranges within each specie's spawn. The frequencies will be compared among the three species to provide insight into geospatial patterns of this genus. The histograms of theses frequencies are expected to exhibit a normally distributed range of protein concentrations per spawn, which over historical time would be logical for their reproduction patterns.

Rodriguez, Victor. Sigma Psi, Florida Institute Technology. District I. Determinants of Reef-Fish Assembly in Pacific and Caribbean Coral Reefs After the Establishment of Marine Protected Areas (MPAs)

Throughout the years, the overexploitation of fisheries has been known for having negative consequences on reef-fish population size. Apart from climate change, it is believed that this anthropogenic phenomenon has the most devastating impact to marine ecosystems worldwide. The main proposed solution for fisheries management in most cases has been to establish marine protected areas (MPAs), in order to increase the yield from adjacent fisheries through time with spillover and larval subsidy. Several studies have shown that the effectiveness of MPAs relies on different factors such as age, size, and effective management. In this study, the main objective is to assess the responses of interactions between fish and benthic communities in a reef-wide manner after the establishment of MPAs. This will be assessed in 2 different geographical zones: The Indo-Pacific and the Caribbean. Fish communities were grouped into different trophic guilds: herbivores, invertivores, piscivores and omnivores. The benthic community on the other hand, was assessed by algae, hard coral and sponge cover percent. The expected results are negative relationships between herbivores and algae cover, as well as positive relationships between herbivores and coral cover.

Dube, Altair. Sigma Psi Chapter, Florida Institute of Technology. Identification of the heat shock protein family in the starfish oocyte and egg

During fertilization, the zygote metabolism increases dramatically. This involves a large increase in protein synthesis. We are interested in understanding how the zygote handles this increased protein load. The heat shock protein family is highly conserved within the genome of most organisms. In many cells, heat shock proteins (Hsp) function as chaperone proteins to bind and aid in conformational change of proteins during synthesis, folding, renaturation, and intracellular transport. In this study, Hsp40, 70, and 90 are studied in the oocyte and fertilized egg of *Patiria miniata* sea star. Through bioinformatic analysis, Hsp40, 70, and 90 mRNA were identified in the *P. miniata* ovary transcriptome on NCBI using human sequences as the query. Antibodies were chosen that bind the region of highest homology against human Hsp40, Hsp70, and Hsp90. They were used in Western blot analysis to positively identify and quantify the Hsp's present in the sea star oocytes and fertilized eggs. Further replication of Western blot analysis is necessary to confirm positive identification of heat shock protein family in *P. miniata*. Additionally, identifying the variation of expressed Hsp's at different times of fertilization could give

further information as to how Hsp's are expressed during fertilization and early development.

Harding, Aubrie; Aliya Davenpor. Psi Pi, Reinhardt University. A preliminary floristic inventory of Funk Heritage Center lands

A floristic inventory of vascular plants was conducted on a tract of land behind the Funk Heritage Center on the campus of Reinhardt University in Waleska, GA. The site boasts multiple habitat types, including a riparian zone, a heavily wooded area, and an open field. A selection of 30 species were pressed and identified in the fall, and will be compared to the selection of species identified this spring. Percentage of invasive, naturalized and native species is calculated, and a species list by family is presented. All specimens are vouchered in the Reinhardt University herbarium (REH) and the label data will be uploaded to the SERNEC portal.

Pakala, Pranaya and Litwa, Karen A. 3-D Cerebral Organoids (mini-brains) from patient-derived induced pluripotent stem cells will model the development of Autism pathology.

Autism spectrum disorders are genetically complex neurodevelopmental disorders that manifest with verbal and nonverbal social deficits as well as restricted and repetitive patterns of behavior. Previous research with idiopathic autism cases demonstrates that post-mortem patient brain samples have an increased number of excitatory synaptic connections in cortical brain samples, the area of the brain responsible for social behavior (PMID: 21346746). However, the use of post-mortem samples prevents us from understanding how these altered neuronal connections arise. Thus, we use patient-derived induced pluripotent stem cells to grow 3-D Cerebral Organoids, or 'mini-brains', which allow us to capture the early events of brain development. These 'mini-brain' mimic brain development by containing diverse brain cells, including neuronal, neural progenitor, and glial cells.

Floyd, Augustus Evan. Tau Gamma, East Carolina University. Motivators for CMA Genetic Testing among Parents of Children with ASD in Eastern North Carolina

While the etiology of autism spectrum disorder (ASD) is unclear, research continues to point genetic causes associated with both development of ASD and hereditary transmission. Roughly half of ASD cases can be traced to copy number variants from point mutations across the genome. Chromosomal Microarray (CMA) was recently endorsed as a first-tier test for ASD by the Medical College of Clinical Genomics. Using a blood sample, genes associated with ASD can be uncovered. This information can be used by families to obtain insurance coverage for treatment and influence family planning for both the parents and individual affected. Additionally, information from CMA is used in examining the genetic origins of ASD. However, utilization for genetic testing is reported as extremely low. Our team sought to determine what factors are important in intention to receive CMA genetic testing among parents of children with ASD. We created an online survey for parents of children with ASD throughout Eastern North Carolina. As a rural population with limited resources and a high incidence of ASD, we sought to determine what factors were significant determinants for genetic testing decision. We analyzed intention for testing in relation to attitudes, knowledge, costs, and motivation about the test.

Windmiller, Reid. Sigma Gamma, Erskine College. A Toxicity Study of Tetracycline and Titanium Dioxide Nanoparticles on the Nematode *C. elegans* and the Rotifer *P. acuticornis*

The use of titanium dioxide nanoparticles in industry has significantly increased in recent years—its most common use being as an ultraviolet absorbing agent in paints and sunscreens. Titanium dioxide is also photocatalytically active and has been studied as an

agent to degrade aqueous organic contaminants. However, there is little consensus to the toxicity of titanium dioxide. The goal of this study was to test the acute toxicity of a PMMA-titania macrosphere and its products of degraded tetracycline at environmental concentrations. In order to determine causes of toxicity, titanium dioxide and tetracycline acute toxicity assays were run under varying light conditions. The test organisms were *Caenorhabditis elegans* nematodes and *Philodina acuticornis* rotifers. Results showed that titanium dioxide was more toxic to nematodes, while tetracycline was more toxic to rotifers. These results would indicate that if the macrosphere or the tetracycline breakdown products were toxic, then the effects would be organism specific. However, the degradation of tetracycline by the macrosphere did not have toxic effects on either organism, indicating that such a system could be non-toxic. Further tests should be run under real environmental conditions, as well as further testing of the PMMA-titania macrosphere for toxicity and efficiency.

Garcia Enrique[1], Andy Maben[2], Taylor Parker[1], Lee Brackman[1] and Carmony Hartwig[1]. Tau Eta Chapter, Catawba College. Wild Brew: Isolation and Genetic Identification of Wild Yeast Strains from Rowan County, North Carolina.

Wild yeast fermentation to create a variety of beers is an ancient technique employed by brewers that has recently resurged in breweries world-wide. Most 'wild' brewers use a mixture of yeast strains from open-air fermentation. Our goal was to isolate and characterize wild yeast isolates from Rowan County for future use in beer varieties of New Sarum Brewery in Salisbury, North Carolina. We hypothesized that wild yeast strains capable of fermenting malt extracts with favorable aromatics could be isolated using the open-air method, and further purified to create in-house isolates for long-term propagation. We placed sterile jars filled with wort in areas that were likely to have sugar-fermenting yeast associated with them (e.g. flowers, leaf material, bee hives). After a 3-week fermentation period, samples were transferred to sterile wort agar plates and passaged several times to ensure axenic yeast culture. Cultures were established with isolated yeast strains to determine fermentation capacity of malt prior to DNA barcoding analysis. Yeast DNA extracts were analyzed via PCR (ITS1-5.8S rDNA-ITS2) as described (Masoud et al., 2004). Sequencing analysis of the amplicons resulted in 100% homology for *Meyerozyma guilliermondii,* a known fermenter of malt extracts that unfortunately yields off-putting bitter flavors.

Austin, Amelia (Chloe Lovelady, Nancy Dalman, Jill Schulze). Psi Rho, University of North Georgia. Varying levels of aggression in correlation with group size of Sergeant Major damselfish (*Abudefduf saxatilis)* in Calabash Caye Reef, Belize

Abudefduf saxatilis (Sergeant Major) is one of many species of damselfish living in the Caribbean. Juveniles often live in large groups, while adults tend to live alone or in small communities. Adult Sergeant Majors are territorial and display aggressive behavior, although territoriality is not commonly observed among juveniles. The purpose of our study was to compare differences in group size and behavior between juveniles and adults at two reef sites near Calabash Caye, Belize: Shallow Patch Reef (SPR) and Calabash Caye Reef (CCR). At each reef, we randomly selected starting points from which we surveyed transects 10 meters in length. We sampled a total of 28 transects. We recorded the number of juveniles and adults, territorial behavior, water depth, and habitat characteristics.We observed that SPR was significantly shallower and held more juveniles when compared to CCR. The adults in the CCR were aggressive whereas the juveniles hid when approached. By schooling together, juveniles may deter potential predators from attacking, thereby increasing their chances of survival. As damselfish mature and grow, their defense mechanisms may differ among patch reefs in order to increase chances of survival.

DISTRICT II JOHNSON AWARD SESSION--WINNERS

First Place Winner of the District II Johnson Award

Pearson, Rachel & Lauren King. Mu Omicron, Columbus State University. Detecting neutrophil apoptosis in response to *Haemophilus influenza*

Nontypeable *Haemophilus influenzae* (NTHi) is a gram-negative pathogen that is a member of the normal flora of the nasopharynx in up to 80% of adults. In healthy individuals, NTHi is typically asymptomatic, but with improper mucosal clearance can cause infections like rhinosinusitis, pharyngitis, and otitis media despite significant white blood cell responses to the site of infection. Our project focuses on describing this ineffective clearance within the host. Neutrophils combat bacterial infections primarily through phagocytosis with varying degrees of efficacy, ultimately leading to apoptosis of the white blood cells and death of the pathogen. This study aims to elucidate the pathway of cell death in response to NTHi infection by examining viability of neutrophils exposed to the bacteria. Human neutrophils were isolated from healthy adults, infected with NTHi, and tested for viability with and without apoptosis inhibition using a trypan blue assay and determining DNA fragmentation. Apoptosis was detected and the amount of caspase-3 was quantified using a colorimetric assay. Upon exposure to NTHi, neutrophil cell death increased and there was an increase in caspace-3 activity, suggesting that *H. influenzae* may damage these immune cells in vivo, offering a possible explanation for ineffective clearance.

Second Place Winner of the District II Johnson Award

Johnson, Lauren. Mu Omicron, Columbus State University. The Involvement of Estrogen Receptors in Astrocyte Survival

Estrogens have various physiological effects and are demonstrated to be neuroprotective. The levels of estrogen decline during menopause which can cause a variety of symptoms. Hormone replacement therapy (HRT) is a common treatment option for alleviating these symptoms, although there can be associated adverse side effects. Estrogen interacts with two receptors, estrogen receptor (ER) alpha and beta, which are expressed at different levels in the body. Of the treatment options for adverse side effects of HRT, Selective estrogen Down-regulators (SERDs) do not appear to have an agonist effects on estrogen receptors while Selective estrogen receptor Modulators (SERMs) do. The aim of this study was to determine the role that estrogen receptors play in astrocyte survival when placed under stress with epinephrine as well as when treated with Fulvestrant, a well-known SERD. The results of this experiment indicated estrogen treatment did not offer any neuroprotection, although prior studies have shown otherwise. Epinephrine did not appear to be a significant stressor in this study. Treatment with Fulvestrant did not have any effect on cell viability for cells treated with or without estrogen. Future studies should further evaluate the genomic mechanisms of estrogen signaling and the role of the estrogen receptors.

Third Place Winner of the District II Johnson Award

Byrd, William; Mukherjee, Angana; Ahmed, Saeed; Theodore, Shanice; Jones, Jacqueline. Foxi3 Ablation Retards Bone Derived Prostate Cancer Cell Growth

Prostate cancer is the abnormal growth of cells in the prostate gland and studies have shown that 100% of men that die from prostate cancer have bone involvement. Of the many cells resident in the bone, myeloid cells secrete various soluble factors that contribute to the high turnover rate of cells and molecular processes of bone development.

Of particular interest, Foxi3, a forkhead family transcription factor is critical in bone development and embryogenesis. However, its role in prostate cancer, has not been explored. Therefore, we hypothesized that Foxi3 is a key factor in promoting prostate cancer progression to the bone and its expression is modulated by FGF8. To investigate the clinical role of Foxi3 and study the effect of FGF8 on Foxi3 high expressing cells (PC3 and C42b), we analyzed its expression and function in human prostate cancer tissue and cell lines with or without FGF8 treatment. A significant increase in Foxi3 expression as cancer becomes more aggressive is identified in human specimens ($p<0.01$). Immunohistochemical analysis demonstrated a significant association of Foxi3 expression with tumor grade ($p<0.05$) and pathology ($p<0.01$). Further, C42b cells treated with FGF8 presented an 83-fold increase in Foxi3 expression and a significant increase in migration and proliferation rate ($p<0.001$). Interestingly, Foxi3 inhibition (si-RNA-Foxi3) in PC3 and C42b cells, significantly decreased cell proliferation and migration ($p<0.01$), even in the presence of FGF8. Together, our findings illustrate a synergistic oncogenic role of Foxi3 and FGF8 in promoting prostate cancer bone metastases

Honorable Mention Winner of the District II Johnson Award

Pitts, Rowan and Lauren King. Mu Omicron, Columbus State University. Intracellular survival of *Acinetobacter baumannii* in human neutrophils

The emergent pathogen *Acinetobacter baumannii* is responsible for a significant proportion of nosocomial infections. Due to multidrug-resistance (MDR), common antibiotic treatment of *A. baumannii* is often ineffective and mortality is high. *A. baumannii* adheres to biological and abiotic surfaces by forming biofilms which contributes to drug resistance and evasion of the host immune system. Neutrophils have been demonstrated to play a key role in in vivo clearance, as these cells play a critical role in our immune system, protecting against pathogenic bacteria by concentrating at sites of infection in order to eliminate bacteria by phagocytosis. Understanding how *A. baumannii* interacts with our innate immune system could help elucidate its pathogenesis. We characterized antibiotic resistance in seven clinical isolates of *A. baumannii* and examined their intracellular survival following neutrophil phagocytosis. We found that all clinical isolates were MDR. When examining phagocytosis, we found a significant variation in intracellular survival. Three of seven clinical isolates did not survive phagocytosis, whereas four strains survived. The pathogen's ability to evade the natural host defense and survive neutrophil phagocytosis demonstrates the severity of *A. baumannii* infections and furthers the understanding of the host-pathogen interaction.

District II Johnson award winners (left to right): Rachel Pearson, Lauren Johnson (not pictured), William Byrd, Rowan Pitts

DISTRICT II JOHNSON AWARD SESSION--OTHERS

Floyd, Jason. Beta Zeta, University of North Alabama. Forensic sample digestion: what microbes are eating human proteins

It is well known that crime scenes often contain biological specimens that are used to facilitate the verdict in forensic and criminal investigations. Often biological specimens, such as blood, urine, saliva, and semen, are detected through the use of a camera with an attached ultra-violet light. When exposed to this specific wavelength of light, body fluids will fluoresce; therefore, the samples can be photographed upon inspection at a crime scene. In this study, cloths of various colors and textures were spotted with blood, urine, saliva, and semen. These cloths were exposed to conditions (sunlight, office light, water, or soil) which mimic locations where soiled clothing may be discarded or hidden during a crime. The samples were treated in these conditions and tested at multiple time points (e.g. initial exposure, 24h, 48h, 1wk, 2wk, 4wk). Bacteria were then isolated from each exposure condition (creek water and soil) and identified using either DNA sequence analysis or the BioLog identification system. The purpose of this study is to isolate bacteria found within each treatment condition, and identify the bacteria present. The identification of the bacteria present in each treatment condition will allow for a better understanding of the microbes that could be consuming biological specimens on cloths found at crime scenes. To date, fluid sample longevity based on light exposure has been tested. It was found that fabric samples containing body fluids exposed to creek water and soil more rapidly degrade compared to samples exposed to sunlight and office light. This project focused on identifying bacteria within soil and water exposure condition that potentially degrade human proteins found in blood, urine, saliva, and semen.

Bokenfohr, Kristina. Mu Epsilon, Troy University. Effect of Crude Oil on Vibrio parahaemolyticus, a Causative Bacterium of Seafood Poisoning

Vibrio species are Gram-negative, curved-rod shaped, facultative bacteria that are motile by polar flagella. Natural habitats of this genus are freshwater and marine ecosystems. It has been reported that several Vibrio species cause disease in humans. Among these, Vibrio parahaemolyticus is a major pathogen responsible for food-borne infection, usually associated with consumption of raw or undercooked seafood such as oysters. Meanwhile, catastrophic oil spill in the Gulf of Mexico happened in 2010 and caused a great impact on marine ecosystems including bacterial community. Here we design an experiment to answer whether the oil spill is beneficial or harmful to pathogenic V. parahaemolyticus. Molecular-based techniques will be used to detect and monitor the fate of V. parahaemolyticus in salt marsh sediments after exposure to crude oil. We expect that our study will provide the background needed to better understand and control Vibrio species threatening public health and safety.

Bennett, Callie. Mu Epsilon, Troy University. Bacterial communities residing in core and surface of tar balls on the Gulf coast beaches

Tar balls are the remainder traces of petroleum located along the shoreline following oil spills or oil seeps. Multiple features of tar balls favor the qualities of a biofilm-forming environment, characterizing them as a feasible and attainable microcosm for bacteria. A considerable amount of research has given prominence to oil-biodegrading microbial communities in marine tar balls, as a study by Tao et al. in 2011 revealed that tar ball samples collected on the Gulf coast contain an unusual accumulation of non-hydrocarbonoclastic bacteria Vibrio vulnificus, a human pathogen. To gain a better understanding of other factors influencing the microbial presence in tar balls, this study proposes to investigate the internal and external environment of marine tar balls collected along the Gulf coast. After the collection of tar balls along the Gulf Coast of Alabama is

complete, DNA will be extracted from the outside and inside of sampled tar balls to analyze bacterial community structures using PCR-DGGE and DNA sequencing.

Yislain Villalona, Jamie Weimer, Lisa Massie, Cecile Marczinski, and Christine Perdan Curran. Sex and dose-related differences in behavior following excess taurine consumption by B6 mice during adolescence and early adulthood

Energy drinks are a multi-billion dollar industry with 14.3 percent growth projected in 2017 and $8.1 billion in sales. The amino acid taurine is found in high concentration in many energy drinks. Although taurine has shown some benefit as a neuroprotectant in the aged brain, our previous studies and those of others indicate that high-dose taurine can be neurotoxic to the developing brain. We followed up our initial findings with a dose-response study: providing 0, 0.06% or 0.12% taurine in drinking water beginning at P28 until early adulthood. Here we report findings from tests of anxiety, social recognition and alcohol preference, because human studies have shown that energy drinks can increase alcohol consumption. There were no significant differences in the marble-burying test of anxiety. In a standard 3-chamber test of socialization and social recognition, the low-dose taurine mice spent the shortest amount of time in the chamber with a stranger mouse in phase one (two empty chambers and one with a novel mouse inside a wire cage) and taurine-treated male mice spent less time with the stranger mouse than control males, but the differences were not statistically significant ($P > 0.05$). We used a standard alcohol preference test with the concentration of alcohol increasing from 2-10 percent over several days. There was a significant sex x treatment interaction with high-dose males drinking less 2% alcohol, a trend for significant for 5% alcohol consumption with females drinking more than controls and high-dose males drinking less ($P = 0.052$). The same pattern was seen for consumption of 10% alcohol, but in that phase, the sex x treatment interaction was significant ($P < 0.05$). We conclude that excess taurine consumption during adolescence and early adulthood can have important behavioral effects and the interaction between energy drinks and alcohol consumption is in need of further study. Supported by ES02005, GM103436 and AA019795.

Hilpertshauser, Leah. Beta Zeta, University of North Alabama. The physico-chemical relationship between an open and closed canopy reach of a first-order stream, containing *Elimia paupercula*

Association of Southeastern Biologists

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The program committee wishes to thank Mark Suggs, ***abi***GRAPHICS, for formatting the program. We also thank Chris Fleming for creating the Mobile App., Sunny Fleming and Ashley Morris, for maintaining the ASB webpage.

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Exhibit Hall B is the hub of our conference. Registration, along with 25 vendors and academic programs, are located in the hall. New this year is a **Cash Bar** open during our **PM Posters Sessions**, a **charging Station** and a **Lounge Area**. Of course all **coffee breaks** and the **Silent Auction** will be there as well. Come Enjoy the Hall with colleagues and friends!

	Registration	**Exhibits Open**
Wednesday	11:00 AM–9:00 PM	9:00 PM–10:30 PM
Thursday	7:00 AM–5:30 PM	8:00 AM–5:00 PM
Friday	7:00 AM–12:00 PM	8:00 AM–5:00 PM

Silent Auction

Organizers: **Patricia Cox *and the Fabulous Silent Auction Sisters***: Kim Marie Tolson, Pat Parr, Eloise Carter, Bonnie Kelley, and Diane Nelson.

Established in 2006, it raises money to help defer travel costs for graduate student members presenting papers/posters at the Annual Meeting. Since 2006, ASB has granted more than $35,000 to defer travel costs for graduate students, and the silent auction has added an additional $11,000 to this effort.

Bring your donation to Silent Auction Area (Exhibit Hall before 10:00AM Thursday March 30).

Exhibitors and Exhibit Hall Layout

Thank you to our wonderful Exhibitors for their support of ASB!

BOOTH 1 – **Alabama State University**

BOOTH 2 – **Troy University** (troy.edu) Dept. of Biology and Environmental Sciences has two master's degree programs (Environmental and Biological Sciences and Biomedical Sciences) both with thesis and non-thesis options.

BOOTH 3 – **University of Georgia Press** (www.ugapress.org) is the oldest and largest book publisher in the state. We currently publish 60-70 new books a year.

BOOTH 4 – **Eagle Hill Publishers**

BOOTH 5 – **Association of Southeastern Biologists** (sebiologists.org) Promoting biology through research and education for more than 75 years.

BOOTH 6 – **University of Alabama Press** (www.uapress.ua.edu) As the scholarly publishing arm of The University of Alabama, it serves as an agent in the advancement of learning and the dissemination of scholarship.

BOOTH 7 – **Southern Appalachian Botanical Society** (sabs.us) Southern Appalachian Botanical Society (SABS) is an organization that focuses on the botany of the entire eastern United States.

BOOTH 8 – **Western Carolina University** (https://www.wcu.edu/) Western Carolina University offers a M.S. degree in Biology focused on thesis based. Research areas of interest range from animal behavior to protein folding.

BOOTH 9 – **James Madison University** (https://www.jmu.edu/biology/) Department of Biology, graduate program recruiting

BOOTH 10 – **University of Southern Mississippi** (https://www.usm.edu/graduate-school) Graduate School at the University of Southern Mississippi, offering M.S. and Ph.D. degrees in Biology

BOOTH 11 – **Middle Tennessee State University** (www.mtsu.edu/graduate) The MTSU College of Graduate Studies gives students a vast array of academic offerings, with more than 100 programs of study from which to choose.

BOOTH 12 – **Georgia Southern University** (http://cosm.georgiasouthern.edu/biology/) The Dept. of Biology at Georgia Southern University is a student-centered, "full-service" department offering training from the molecular to the ecosystem level.

BOOTH 13 – **Kennesaw State** University (csm.kennesaw.edu/msib - Master of Science in Integrative Biology (MSIB)

BOOTH 14 – **University of Tennessee Chattanooga** (http://www.utc.edu/biology-geology-environmental-science/) The BGES Dept. offers undergraduate degrees in Biology, Geology, Env. Sci. and STEM Edu. and a M.S. degree in Environmental Science

BOOTH 15 – **Carolina Biological Supply** (www.carolina.com) is a worldwide leader in providing top-quality, innovative science and math materials for K-16 educators. The Carolina™ Science catalog is available free on request.

BOOTH 16 – **National Association of Biology Teachers** (http://www.nabt.org) NABT is the recognized "leader in life science education." We support thousands of K-16 educators who want to interact with colleagues and grow professionally.

BOOTH 17 – **Associated Microscope** (www.associatedmicroscope.com) microscope sales, microscope, balance and spectrophotometer service

BOOTH 18 – **Tri-Beta** (tri-beta.org) National Undergraduate Honors Society for promotion of Undergraduate Research

BOOTH 19 –**Vashaw Scientific, Inc**. (www.vashaw.com) Vashaw Scientific, Inc. is a full service microscopy, imaging and material sample preparation provider servicing the Southeast since 1978.

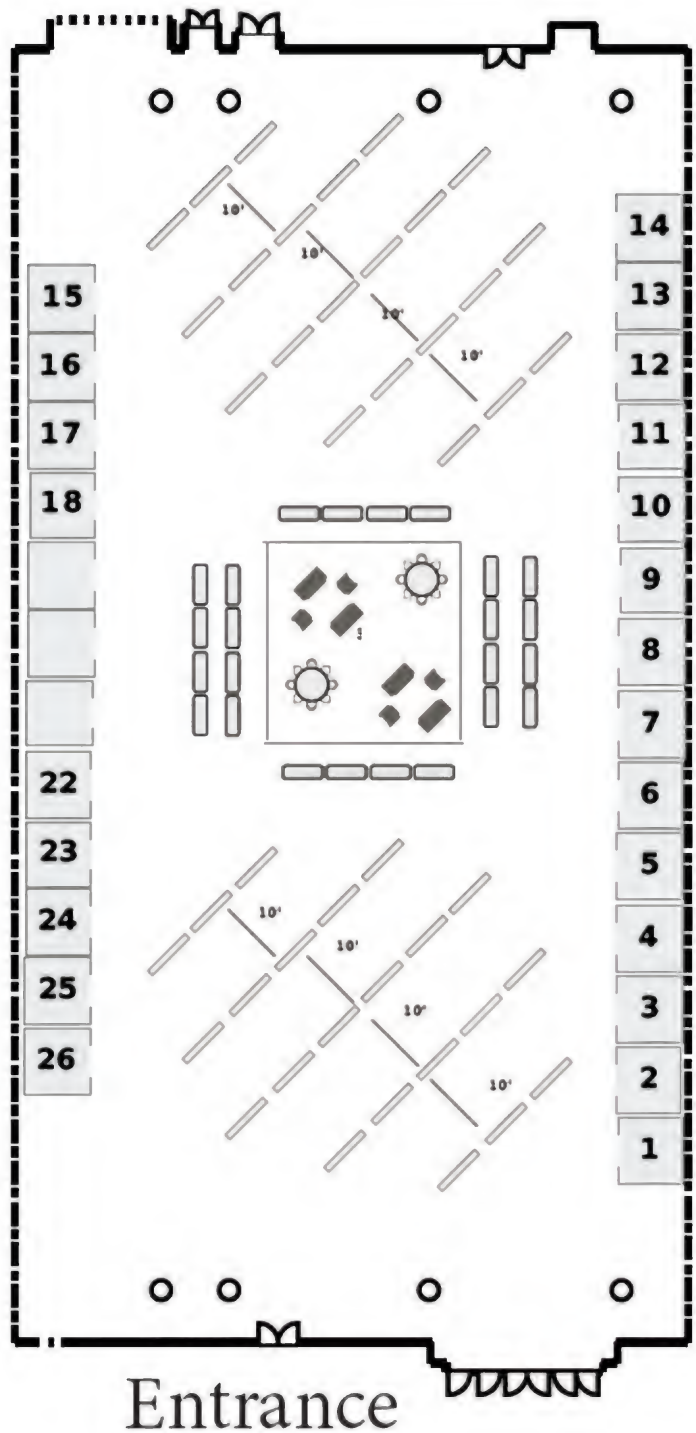
BOOTH 20 &21 – **Fine Designs** (https://finedesigns.com/) Custom apparel printed on-site. Build your own ASB shirt at the conference!

BOOTH 22 – **Forestry Suppliers, Inc.** (www.forestry-suppliers.com) offers a complete selection of tools, gear and equipment for forestry, wildlife management, wildland firefighting, environmental and other outdoor markets since 1949.

BOOTH 24 – **Medical Inc**. (http://medicalinc.org/) is dedicated to quality preventative maintenance, service and repair of laboratory, life sciences and research equipment for Colleges & Universities

BOOTH 25 – **Alabama Department of Environmental Management** (adem.alabama.gov) The Alabama Department of Environmental Management (ADEM) administers all major federal environmental laws, and monitors environmental conditions, and recommends changes to regulations in Alabama.

BOOTH 26 – **Martin Microscope** (www.martinmicroscope.com) sells microscopes and digital microscopy systems for education, laboratory, and research.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Entrance

Plenary Speaker

Dr. Lafayette Fredrick

Fellow, and Lifetime Mentor Award, American Association for the Advancement of Science
Lifetime Achievement Award, NSF Education and Human Resources Directorate
Lifetime Achievement Award, Association of Southeastern Biologists
Meritorious Teaching Award, Association of Southeastern Biologists
Distinguished Alumni Merit Award, Tuskegee Institute

Impact of ASB on the Development of Minority Biologists from the Southeast

Wednesday, March 29th • 7:30 PM–9:00 PM • Alabama AB

Dr. Frederick, was born in Dog Bog, Mississippi, but raised on cotton farms in SE Missouri. His early education was in a one-room schoolhouse, where his father taught. His experiences on the farm sparked his interest in nature and ultimately led to his enrollment in the Tuskegee Institute, where he studied agriculture and was introduced to Botany. Dr. Fredrick earned his B.S. degree in Biology in 1943 and then joined the Navy and was stationed in Pearl Harbor, HI. After WW2, he studied native plants at the University of Hawaii, and later earned an M.S. in Botany from the University of Rhode Island and a PhD in Plant Pathology and Botany from Washington State University. He held numerous postdoctoral positions: Cornell University, University of Illinois and University of Michigan and academic positions at Southern University, Atlanta University, Howard University, and Tuskegee University. In a time of racial segregation he worked tirelessly to introduce young African Americans to the field of science. He joined ASB in 1955 but was not allowed to attend the meeting until 1958 where he presented his first paper. He has attended almost every annual meeting since and has brought many students with him to present papers and posters. Dr. Fredrick has served ASB as President, Vice President, Executive Committee member, Local Arrangement Committee, and has also received the ASB Meritorious Teaching Award. When asked what he was most proud of in his work, Dr. Fredrick responded: "The opportunity I have had to be a mentor for many outstanding students that have had distinguished careers in their fields of endeavor as professional scientists, academic administrators, corporate executives, and educators; and to have assisted them in developing their talents, elevating their horizons, and in overcoming barriers." Dr. Fredrick has been and continues to be a model scientist and inspiration to us all.

Association of Southeastern Biologists

Meeting-At-A-Glance

Wednesday, March 29–Saturday, April 1 2017
Renaissance Montgomery Hotel & Spa at the Convention Center

Tuesday, March 28

Time	Event	Location
8:00 AM–5:00 PM	Exhibit Hall - Move in and set up	Exhibit Hall B
8:00 AM–5:00 PM	ASB Logistics Room	Riverview Boardroom
8:00 AM–5:00 PM	Registration Set Up	Exhibit Hall B
10:00 AM–12:00 PM	ASB EC VIPs Pre-Convention Mtgs.	TBD
12:00 PM–1:00 PM	ASB EC - Exhibit Hall lay out	Exhibit Hall B

Wednesday, March 29

Time	Event	Location
8:00 AM–5:00 AM	ASB Logistics Room	Riverview Boardroom
9:00 AM–4:00 PM	Exhibitor Set-up	Exhibit Hall B
11:00 AM–9:00 PM	**Registration Open**	Exhibit Hall B
11:00 AM–2:00 PM	Exhibitor's Lunch Break (exhibitors only)	Exhibit Hall B
1:00 PM–6:00 PM	**ASB Executive Committee Meeting**	Riverview 1
1:00 PM–6:00 PM	**SABS Executive Council Meeting**	Riverview 2
7:30 PM–9:00 PM	**Welcome and Plenary Speaker Welcome** **Dr. Karyn Scissum-Gunn,** Interim Provost and Vice President of Academic Affairs, Alabama State University **Dr. Steven Taylor**, Dean College of Arts and Sciences, Troy University **Plenary Speaker Introduction** **Dr. William Luther** Professor of Biology, Director of the Integrative Bioscience PhD Program, Dean of Graduate Studies and Provost/Vice President for Academic Affairs, Distinguished Professor of Biology and Provost/Executive	Alabama AB

	Vice President, Tuskegee University **Plenary Speaker** **Dr. Lafayette Fredrick** Fellow and Life Mentor Award Recipient, AAAS Lifetime Achievement Award, NSF Education and Human Resources Directorate Lifetime Achievement Award, ASB Tuskegee Institute Distinguished Alumni ***Impact of ASB on the Development of Minority Biologists from the Southeast***	
9:00 PM–10:30 PM	**Plenary Welcoming Social**	Exhibit Hall B

Thursday, March 30

Time	Event	Location
7:00 AM–5:30 PM	**Registration Open**	Exhibit Hall B
7:00 AM–5:00 PM	PowerPoint Preview Check ASB Logistics Room	Montgomery 4 Riverview Boardroom
7:00 AM–8:15 AM	**ASB Past President's Breakfast Meeting**	Riverview 2
7:00 AM–5:00 PM	**ASB POSTER SESSIONS** **ASB Posters (1– 116, Sessions 1 & 2) set up 7:00–8:00 AM** Presenters of **odd-numbered posters** (Poster Session 1) must be present 9:30–11:00 am. Presenters of **even-numbered posters** (Poster Session 2) must be present 3:15–4:45 pm **ALL PULSE Posters** (**301-329**) presented in **PM Session**	Exhibit Hall B
8:00 AM–5:00 PM	**Exhibits Open**	Exhibit Hall B
8:00 AM–12:00 PM	**Workshop** **Improving Scientific Communication: Crafting Your Message** Organizer: Bruce Kirchoff (UNC Greensboro) (workshop attendance limited to the first 12 attendees)	Montgomery 6

8:15 AM–9:30 AM	**ASB Paper Presentations** Teaching and Learning Microbiology Entomology/Invertebrates/Parasitology Ecology: Aquatic Ecology: Conservation **Symposium**: Advancing Herbaria in the Age of Digitization Organizers: *Wendy Zomlefer (University of Georgia) and Richard Carter (Valdosta State University)*	Montgomery 7 Montgomery 1 Alabama C Alabama D Alabama E Alabama B
9:30 AM–11:00 AM	**Break for Poster Session 1 and Coffee** • No talks at this time Presenters of **odd-numbered posters** (**1 - 116**) must be present	Exhibit Hall B
11:00 AM–12:15 PM	**ASB Paper Presentations** Teaching and Learning Microbiology Entomology/Invertebrates/Parasitology Ecology: Aquatic Ecology: Conservation **Symposium**: **Advancing Herbaria in the Age of Digitization** Organizers: *Wendy Zomlefer (University of Georgia) and Richard Carter (Valdosta State University)*	Montgomery 7 Montgomery 1 Alabama C Alabama D Alabama E Alabama B
12:15 PM–2:00 PM	**Lunch (Individuals and Organizations)** **ASB Diversity Committee Lunch** **SHC SE Chapter Luncheon/Business Meeting**	Riverview 1 Riverview 4

Thursday, March 30

1:00 PM–4:00 PM	**β β β Field Trip to Jasmine Gardens** (βββ members only)	Meet in Hotel Lobby
2:00 PM–5:00 PM	**Workshop:** **HHMI Biointeractive** Organizer: Brenda Royal	Montgomery 6
2:00 PM–3:15 PM	**ASB Paper Presentations** Teaching and Learning Ecology: Ecosystems	Montgomery 7 Alabama B

	Entomology/Invertebrates/Parasitology Ecology: Aquatic Ecology: Conservation **Symposium**: **2nd Annual Southeastern Symposium on Zebrafish Development and Genetics** Organizer: *Ted Zerucha (Appalachian State University)*	Alabama C Alabama D Alabama E Montgomery 1
3:15 PM–4:45 PM	**Break for Poster Session 2 and Coffee** • No talks at this time Presenters of **ASB even-numbered posters** (**2- 116**) must be present. **ALL PULSE Poster presenters** should be present.	Exhibit Hall B
4:45 PM–5:45 PM	**SABS/BSA Student Reception**	The Exchange Outdoor Patio
5:00 PM	Poster Removal	
6:00 PM—11:00 PM	**Thursday Night ASB Social** ***Live Music, Food, Drinks, Games***	Biscuit Stadium

Friday, March 31

Time	Event	Location
7:00 AM–12:00 PM	**Registration Open**	Hall B
7:00 AM–8:15 AM	**SABS/BSA Breakfast Meeting**	Riverview 1
7:00 AM–5:00 PM	PowerPoint Preview Check ASB Logistics Room	Montgomery 4 Riverview Boardroom
7:00 AM–5:00 PM	**ASB POSTER SESSIONS** **ASB Posters (117–248, Sessions 3 & 4) set up 7:00–8:00 AM** Presenters of **odd-numbered posters** (Poster Session 3) must be present 9:30–11:00 am. Presenters of **even-numbered posters** (Poster Session 4) must be present 3:15–4:45 pm	Exhibit Hall B
8:00 AM–NOON	**βββ POSTER SESSIONS** β β β Poster set up 8:00 AM–9:00 AM. Present Presenters must be present 9:30 AM–NOON	Exhibit Hall B
8:00 AM–6:00 PM	β β β Officers & Judges Room	Riverview 8

Friday, March 31

8:00 AM–NOON	**Workshop:** **Improving Scientific Communication: Adding Enthusiasm to your Presentation** **Organizer**: Bruce Kirchoff (UNC Greensboro) (workshop attendance limited to the first 15 attendees)	Montgomery 6
9:00 AM–9:30 AM	β β β Joint Business Meeting (all delegates MUST attend)	Riverview 7
8:15 AM–9:30 AM	**ASB Paper Presentations** Cell and Molecular Biology Evolution and Genetics Plant Biology/Ecology Ecology: Populations and Communities **Symposium:** **Southeastern Regional PULSE Institutes: Inspiring department level transformation of life sciences undergraduate education** Organizers: Judy Awong-Taylor and Chris Finelli Full list of organizers on page 12 (**Closed Session-Please see PM schedule for a PULSE Workshop open to all Conferees**) **Symposium:** **Space and time in southeastern ecosystems: ESA SE Chapter new research symposium** **Organizers**: Julie Tuttle (UNC Chapel Hill), Alan Wilson (Auburn University), and Matt Waters (Auburn University)	Montgomery 1 Montgomery 7 Alabama C Alabama D Alabama B Alabama E
9:30 AM–11:00 AM	**Break for Poster Session 3 and Coffee** • No talks at this time **ASB presenters** of **odd-numbered posters (117—248)** must be present at this time.	Hall B
11:00 AM–12:15 PM	**ASB Paper Presentations** Cell and Molecular Biology Evolution and Genetics Plant Biology/Ecology Ecology: Populations and Communities	Montgomery 1 Montgomery 7 Alabama C Alabama D

	Symposium: **Southeastern Regional PULSE Institutes: Inspiring department level transformation of life sciences undergraduate education** **Organizers**: Judy Awong-Taylor and Chris Finelli Full list of organizers on page 12 (**Closed Session–Please see PM schedule for a PULSE Workshop open to all Conferees**) **Symposium:** **Space and time in southeastern ecosystems: ESA SE Chapter new research symposium** **Organizers**: Julie Tuttle (UNC Chapel Hill), Alan Wilson (Auburn University), and Matt Waters (Auburn University)	Alabama B Alabama E

Friday, March 31

12:15 PM–2:00 PM	**Lunch (Individuals and Organizations)** **Education Committee's *Lunch and Learn*: Retention of At-Risk Students** **ESA Luncheon and Business Meeting**	Riverview 4 Riverview 1
1:00 PM–4:30 PM	**βββ Paper Presentations** District I — District II —	Riverview 5 Riverview 7
2:00 PM–3:30 PM	**Workshop:** **Southeastern Regional PULSE Institutes: Inspiring department level transformation of life sciences undergraduate education** (**Open to all conferees**)	Alabama B
2:00 PM–3:15 PM	**ASB Paper Presentations** Cell and Molecular Biology Plant Biology/Ecology Ecology: Populations and Communities Herpetology **Symposium:** **Space and time in southeastern ecosystems: ESA SE Chapter new research symposium** **Organizers**: Julie Tuttle (UNC Chapel Hill), Alan Wilson (Auburn University), and Matt Waters (Auburn University)	Montgomery 1 Alabama C Alabama D Montgomery 7 Alabama E

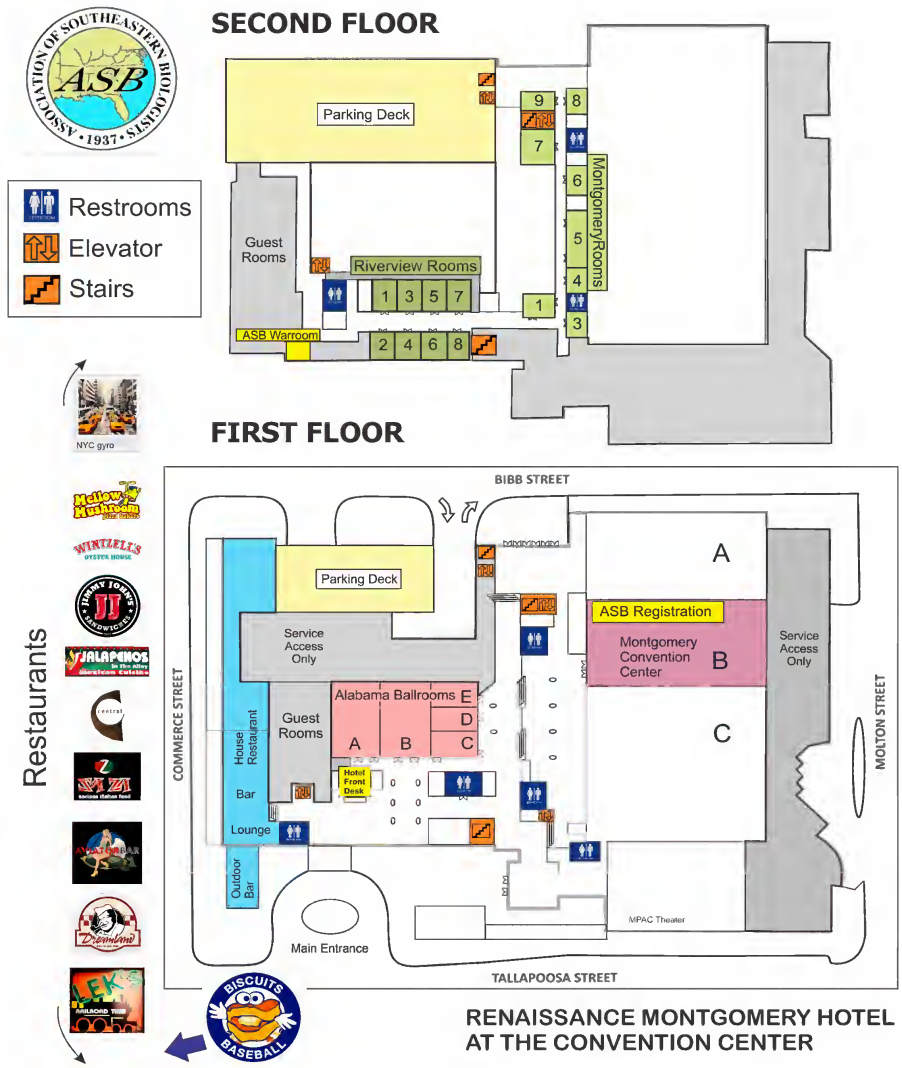
3:15 PM–4:45 PM	**Break for Poster Session 4 and Coffee** • No talks at this time **ASB Presenters** of **even-numbered posters (117—248)** must be present at this time.	Exhibit Hall B
4:30 PM–5:00 PM	**β β β District Session Meetings** District I– District II–	 Riverview 5 Riverview 7
5:00 PM	Poster Removal	
5:00 PM–6:00 PM	**β β β Joint Session and Awards**	Alabama C
5:00 PM–6:00 PM	**ASB Business Meeting** (*All ASB members invited)*	Alabama D
6:30 PM–9:00 PM	**ASB Awards Banquet**	Alabama AB

Saturday, April 1

Time	Event	Location
7:30 AM–8:30 AM	**ASB Executive Committee Breakfast**	Montgomery 5
8:00 AM–2:00 PM	**Workshop** **SERNEC** **Organizer:** Zack Murrell (Appalachian State Univ.)	Riverview 1
8:30 AM–NOON	**ASB Executive Committee Meeting**	Montgomery 5

Hotel Parking - $10 Daily Self-parking. Valet parking Available ($17)

Internet Access - WiFi is complimentary in Hotel and Convention Center. In Hotel, simply follow the instructions found in your guest room. In the Convention Center, connect to Reinnassance_CONFERENCE, your browser will open to a login page, the passcode is ASB2017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Outdoor Bar
Hotel Front Desk
COMMERCE STREET
MOLTON STREET
Main Entrance
MPAC Theater
TALLAPOOSA STREET
Restaurants
RENAISSANCE MONTGOMERY HOTEL
AT THE CONVENTION CENTER

Symposia	
THURSDAY 08:15 AM– 12:15 PM Alabama B	**Advancing herbaria in the age of digitization** **Organizers:** Wendy Zomlefer (University of Georgia) and Richard Carter (Valdosta State University) There is a great need for professional development opportunities for new and experienced curators. The Society of Herbarium Curators, has made great strides in ensuring that botanists have access to presentations about herbaria, especially on topics concerning proven strategies that can be replicated beyond one institution. Our symposium will provide new ideas for increasing the broader impact of herbaria, with focus on demonstrating the value of collections. We have assembled speakers from Botany 2016 and other venues that include curators and non-curators, students and early-career botanists. This panel of invited speakers will share their successes and advice for proactively managing herbaria in this era of difficult internal and external support. Attendees will hear how natural history collections impact formal education, public outreach and service to the biological sciences. We hope to inspire others to expand their own leadership and opportunities to promote increased use of biodiversity collections in research and teaching. Promoting the value of biodiversity collections to administrators and other professionals, non-scientists, and the public at large ensures collections preservation into the future.
THURSDAY 2:00 PM– 3:15 PM Montgomery 1	**2nd Annual Southeastern Symposium on Zebrafish Development and Genetics** ***Organizer:*** *Ted Zerucha (Appalachian State University)* In the last 20-25 years zebrafish has emerged as a major model system to address questions related to Developmental, Cell and Molecular Biology and has also become a useful teaching tool in the classroom. This symposium is an opportunity for zebrafish scientists from the south east to meet, share ideas and form potential collaborations. The symposium also feature a poster session.
FRIDAY 08:15 AM– 3:15 PM Alabama E	**Space and time in southeastern ecosystems: ESA SE Chapter new research symposium** **Organizers:** Julie Tuttle (UNC Chapel Hill), Alan Wilson (Auburn University), Matt Waters (Auburn Univ.) The southeastern U.S. includes parts of 12 ecoregions (EPA Level III), encompassing high ecosystem diversity that reflects spatial variation in geology, topography, and climate. Disturbance patterns vary across the region as well–from periodic hurricanes that track inland from the coast; to natural and prescribed fire in forests of the coastal plain, piedmont, and inland plateau; to landslides, ice storms, and insect outbreaks in the mountains–and combine with changing land use, species invasions, and climate change to further influence ecosystem diversity and dynamics. This symposium features new research across space and time in southeastern ecosystems, highlighting the rich array of ecological questions and

	approaches generated by this complex region. Presentations will encompass a range of ecological systems and issues, including spatial patterns of biodiversity; mountain forest dynamics; long-term fire history; seed dispersal under climate warming; narratives of deforestation; land cover and stream quality; nutrient enrichment in freshwater systems; cross-scale effects in coastal systems; sea level rise and plant community disassembly; succession in metacommunities; herpetofaunal occupancy modeling; and more.
FRIDAY 08:15 AM– 12:15 PM Alabama B	**Southeastern Regional PULSE Institutes: Inspiring department level transformation of life sciences undergraduate education** **Organizers** Chris Finelli, University of North Carolina Wilmington; Karen Aguirre, Coastal Carolina University; Judy Awong-Taylor, Georgia Gwinnett College; Jung Choi, Georgia Institute of Technology; Ellen S. Goldey, Florida Atlantic University; Mary Smith, North Carolina A&T; and Chris Finelli (UNC Wilmington). The Partnership for Undergraduate Life Sciences Education (PULSE) is a national initiative developed by leaders at NSF, HHMI, and NIGMS designed to inspire whole departments to undertake the types of reforms called for in Vision and Change in Undergraduate Biology Education: A Call to Action. The second summer Southeast Regional PULSE (SERP) Institute was held in June, 2016 at Wofford College and was attended by a diverse set of institutions. Participants developed a plan of action to target improvements to their programs. The morning's session is a poster discussion in which participants will share the progress, challenges, and insights from their work. As part of our IRB for this work, this session is by invitation only. Posters will also be presented during the general ASB Poster Sessions. ASB members are encouraged to stop by, learn what these institutions are doing, and discuss how PULSE and the SERP institutions can inspire their own departments to implement the recommendations of Vision & change.
Workshops	
THURSDAY 8:00 AM– 12:00 PM Montgomery 6	**Improving Scientific Communication: Crafting Your Message** **Organizer**: Bruce Kirchoff We live in a post-truth era; a time where truth is not just relative but manufactured to serve political ends. How can we as scientists who believe that our knowledge has been hard-won and is closer to the truth than any other, convey this to others? We will use traditional storytelling techniques to address this question and improve our presentations. After a brief introduction participants will have the opportunity to work on their presentations, present an abbreviated version, and receive feedback. This is a hands-on workshop, so please bring your laptop and your presentation of your conference talk to the workshop. In addition to preparing your slides, think about what single image would convey the essence of what you want your audience to take away from your talk. **(Attendance limited to the first 12 attendees)**

THURSDAY 2:00 PM –5:00 PM Montgomery 6	**Howard Hughes Medical Institute (HHMI) Biointeractive** **Organizer:** Brenda Royal HHMI Biointeractive is a storehouse of resources for biology educators at all levels. This workshop will provide biology educators with materials to teach the four Big Ideas of AP Biology: evolution, energy, information, and system interactions. Educators will also be introduced to the plethora of materials available through the HHMI Website that are free. Teachers will walk away with lessons in four major areas of biology that can be used the next day in class, including all materials necessary to make them engaging and content rich. A large number of students attending are transitioning from ideals of post-graduate programs to career decisions. The role of science educators cannot be overstated in preparing biologists of the future. This presentation is aimed at current educators, as well as those considering education, as a source of new ideas for the presentation of science to biology students at all levels
FRIDAY 8:00 AM–12:00 PM Montgomery 6	**Improving Scientific Communication: Adding Enthusiasm to your Presentation** **Organizer:** Bruce Kirchoff Drawing Inspiration from The Alan Alda Center for Communicating Science, we will use playful techniques to add enthusiasm to our scientific presentations, which is the single easiest thing you can do to improve your presentations. Participants will come away from this workshop having laughed a lot and with increased confidence in their ability to connect with their audience. This hand-on workshop, does not require advance preparation. **(Attendance limited to the first 15 attendees)**
FRIDAY 2:00 PM – 3:30 PM Alabama B	**Southeastern Regional PULSE Institutes: Inspiring department level transformation of life sciences undergraduate education** **Organizers**: Chris Finelli, University of North Carolina Wilmington; Karen Aguirre, Coastal Carolina University; Judy Awong-Taylor, Georgia Gwinnett College; Jung Choi, Georgia Institute of Technology; Ellen S. Goldey, Florida Atlantic University; Mary Smith, North Carolina A&T The Partnership for Undergraduate Life Sciences Education (PULSE) has a strong regional presence in the Southeast. In this workshop, the Southeast Regional PULSE (SERP) leadership will share insights on how the SERP Summer Institutes of 2014 and 2016 have inspired teams of faculty and administrators from diverse intuitions to re-envision and change their department's approach to undergraduate biology education. Workshop participants will engage with the topics that have emerged as foci for change among the majority of SERP teams: 1) incorporating CUREs (Course-based Undergraduate Research Experiences) into the curriculum and 2) strategies for developing students' cognitive and metacognitive skills. Facilitators will share successes and strategies for overcoming barriers to reform based on the experiences of the diverse institutions that have participated in the SERP Summer Institutes.

SATURDAY 8:00 AM – 2:00 PM Riverview 1	**Southeast Regional Network of Expertise and Collections (SERNEC)** Organizer Zack Murrell (Appalachian State University) The SERNEC all-day workshop will have two goals. One goal is to provide a training session for students and faculty that want an overview of herbarium curation, examining current best practices from plant collecting to digitization and georeferencing. This will be appropriate for beginners or those seeking a primer on recent changes in best practices. A second goal is to provide an update on current opportunities to involve students and volunteers in transcription and georeferencing projects. This will be of particular interest to those that want to add museum informatics projects to their classrooms or to engage native plant, conservation and gardening groups in our regional herbarium efforts. Students, faculty and professional biologists are encouraged to attend. Coffee breaks and lunch will be provided.
βββ Events	
THURSDAY 1:00–5:00 PM	**Field Trip to Jasmine Gardens** (β β β members only) –Depart from Hotel Lobby
FRIDAY 8 AM–NOON	**POSTER SESSIONS in Hall B** Set up 8:00 AM–9:00 AM. Presenters must be present 9:30 AM–NOON
8AM– 6:00 PM	**Officers & Judges Room**–Riverview 8
9–9:30 AM	**Joint Business Meeting (all delegates MUST attend)–**Riverview 8
1:30–4:30 PM	**PAPER PRESENTATIONS: District I** — Riverview 5 D**istrict II** — Riverview 7
4:30–5:00 PM	**District Session Meetings: District I** — Riverview 5 **District II** — Riverview 7
5– 6:00 PM	**Joint Session and Awards–**Alabama C

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Oral Presentations

See the Presentation Abstracts published separately for complete authors listing with affiliations

Thursday AM, March 30th

TIME	ADVANCING HERBARIA IN THE AGE OF DIGITIZATION ALABAMA B	TEACHING AND LEARNING MONTGOMERY 7	MICROBIOLOGY MONTGOMERY 1	ENTOMOLOGY/ INVERTEBRATES/ PARASITOLOGY ALABAMA C	ECOLOGY: AQUATIC ALABAMA D	ECOLOGY: CONSERVATION ALABAMA E
8:00 AM	**[1] How to create opportunities in research, education, and outreach through the formation of an undergraduate Herbarium Army** • Lena Struwe, Megan King					
8:15 AM		**[11] The Use of Student Response Systems to Increase Student Engagement in Human Anatomy and Physiology Courses at Jacksonville State University** • James Rayburn	**[20] Detection and Characterization of Biosurfactants Produced by the *Kistimonas* Species** • Emily Linton et al.	**[30] Techniques to Examine Insect Haustellate Mouthparts** • Alison M. Arling, et al.	**[40] Overview of an aquatic micro-ecosystem at Blount Springs, Blount County, AL** • David Johnson, David Frings	**[50] Amphibian and reptile community responses to prescribed burning and thinning in Alabama's Bankhead National Forest** • Iwo Gross, Yong Wang
8:30 AM	**[2] Lessons learned in building educational networks that incorporate natural history collections** • Anna Monfils	**[12] Differing Appearance of Starch Granules In Waxy and Starchy Potatoes** • Glenn Cohen, James Sanders	**[21] Diversity of *Escherichia coli* found in sand of South Carolina beaches** • Savannah Moritzky, et al.	**[31] What the butterfly proboscis has been hiding** • Charles E. Beard, Peter H. Adler, Konstantin G. Kornev	**[41] Extremophile Association with Geologic Setting in Sulfur Springs at Blount Springs, Alabama** • David Frings, David Johnson	**[51] Ecology of Bald Eagles (*Haliaeetus leucocephalus*) in Alabama** • Andrew Coleman
8:45 AM		**[13] Non-majors Biology Students' Environmental Knowledge and Perceptions About Conservation after Participating in Invasive Pest Plant Removal Projects** • Kim Sadler, et al.	**[22] The Effects of Coastal Renourishment on the Presence of *Escherichia coli*** • Jordan Lewis, et al.	**[32] A survey of freshwater snails and their parasites in Alabama.** • Lori Tolley-Jordan, et al.	**[42] Oyster Restoration Utilizing Artificial Substrates: Implications for Mitigating Oyster Decline in the Chesapeake Bay** • Jessie Mandirola, Patrice Ludwig	**[52] Evaluating the Role of Fish as Surrogates for Amphibians in Ecological Risk Assessment** • Scott Glaberman, et al.
9:00 AM	**[3] ADBC and iDigBio: Advances in Herbarium Digitization** • Gil Nelson	**[14] Using HHMI Resources to Maximize Biology Instruction** • Brenda Royal	**[23] A Novel Description of Microbial Population Diversity in the Intestinal Lymphatic Fluid Chyle** • Timothy Odom, Rune Toms, MD, Michael Sandel	**[33] Kinorhynch assemblages in the northern Gulf of Mexico continental shelf** • Stephen Landers, et al.	**[43] The Influence of Poultry Rearing Facilities on Streams and Stream Fish in the Upper Savannah River Basin** • Jocelyn Stalker, et al.	**[53] Development of a decision support tool for Birmingham Audubon's Urban Bird Habitat Initiative** • Jonathan Pitchford, Andrew Coleman

TIME	ADVANCING HERBARIA IN THE AGE OF DIGITIZATION ALABAMA B	TEACHING AND LEARNING MONTGOMERY 7	MICROBIOLOGY MONTGOMERY 1	ENTOMOLOGY/ INVERTEBRATES/ PARASITOLOGY ALABAMA C	ECOLOGY: AQUATIC ALABAMA D	ECOLOGY: CONSERVATION ALABAMA E
9:15 AM	**[4] Survival at a Small Regional University** • Richard Carter	**[15] Teaching Genetics in the Age of Personal Genomics** • Steve Coggin	**[24] Determination of DNA Extraction Protocol Impacts on Detection of *Wolbachia* in Insects.** • Laura D'Alessio, et al.	**[34] Stayin' Alive: Evidence for Learning in Aphids** • Edward B. Mondor, Jessica Durrence	**[44] Effects on *Campostoma oligolepis* digestive morphology and gut microbiota composition across a gradient of urbanization** • Hannah Grice, et al	**[54] The Effect of Conventional versus Rotational Cattle Management on Pasture Soil Carbon and Bulk Density: Implications for Climate Change** • Kelly Livernoche, Heather Griscom
9:30 AM– 11:00 AM	**BREAK for Posters, Exhibitors, and Coffee** **ASB Poster Session 1 (P001–P115, odd numbered posters presented) • Exhibit Hall B**					

Thursday AM, March 30th

TIME	ADVANCING HERBARIA IN THE AGE OF DIGITIZATION ALABAMA B	TEACHING AND LEARNING MONTGOMERY 7	MICROBIOLOGY MONTGOMERY 1	ENTOMOLOGY/ INVERTEBRATES/ PARASITOLOGY ALABAMA C	ECOLOGY: AQUATIC ALABAMA D	ECOLOGY: CONSERVATION ALABAMA E
11:00 AM	**[5] The Dynamic Herbarium: Add Some Zest to Your Presentations!** • Wendy Zomlefer		**[25] Fish gut micro biomes: action and reaction** • Dijon Cousins, et al.	**[35] Invasive Species Alter Parasite Communities in the Southeastern US** • Matthew Heard	**[45] Examining Behavior Syndromes in *Orconectes durelli* Crayfish** • W. Kody Muhic, John Niedzwiecki	**[55] Profiling Bat Species Presence and Activity in Managed Longleaf Pine Landscapes** • Maggie Aduddell Hunt, Thomas McElroy
11:15 AM	**[6] A Multi-Year Project Demonstrates that Botany-naïve Undergraduates Are Critical Partners in Herbarium Digitization Efforts** • Emily Gillespie	**[16] SEA-PHAGES (Science Education Alliance-Phage Hunters Advancing Genomics and Evolutionary Science): Implementing a freshman undergraduate research course at a public comprehensive university** • Victoria Frost, Kristi Westover	**[26] Identification of a Toxin Producing Unknown Bacterial Species Isolated from an Urban Pond** • Elizabeth Castiglione, Alfredo Leon	**[36] The Effects of Background and Illumination on the Foraging Behavior of Naïve *Manduca sexta* Hawkmoths** • William Kuenzinger, et al.	**[46] 4-Methylcyclohexane-ethanol Acute Toxicity to Daphnia and Its Effects on General Esterase and Glutathione S-Transferase Activity in Fathead Minnows** • Jared Lewis, et al.	**[56] Seed banking for Resiliency: Seed Collections for Coastal Restoration in the Eastern United States** • Amanda Faucette, et al.

TIME	ADVANCING HERBARIA IN THE AGE OF DIGITIZATION ALABAMA B	TEACHING AND LEARNING MONTGOMERY 7	MICROBIOLOGY MONTGOMERY 1	ENTOMOLOGY/ INVERTEBRATES/ PARASITOLOGY ALABAMA C	ECOLOGY: AQUATIC ALABAMA D	ECOLOGY: CONSERVATION ALABAMA E
11:30 AM	**[7] The Worldwide Engagement for Digitizing Biocollections (WeDigBio) event—A Global Stage for Your Herbarium** • Austin Mast, et al.	**[17] An alternative grading strategy to more accurately reflect student learning** • Kevin Drace	**[27] Degradation of aromatic dyes by bacteria isolated from soils previously exposed to aromatic compounds and by common lab bacterial cultures** • E. Skye Webb, Henry Sprtt	**[37] Climate Change and the Effect of Temperature on the Release of *Proterometra macrostoma* (Trematoda: Digenea) Cercariae from their Snail Intermediate Host, *Pleurocera semicarinata* (Gastropoda: Pleuroceridae).** • Robin Hauschner, et al.	**[47] The effects of a trophic cascade and trait-mediated interactions have on the survival rate of the Southern Oyster (Crassostrea virginica)** • Krystin Estes, et al.	**[57] Using dynamic occupancy models to investigate inter-annual shifts in seabird distributions in southern New England** • Nicholas Flanders, et al.
11:45 AM	**[8] CollectionsEducation.org: Connecting Students to Citizen Science and Curated Collections** • Erica Krimmel, et al.	**[18] Metacognition in college students: what is it and why should faculty care about it?** • Chris Barton	**[28] Bacterial contamination in the environment of neonatal and pediatric intensive care units** • Henry Spratt, et al.	**[38] Examination of the relative abundance, species richness and diversity of mosquitoes on the campus of Berea College during the mosquito season of 2016.** • Jillian Kendall, et al.	**[48] The impact of a reduced tree canopy cover on the composition of stream macroinvertebrate communities** • Sandra Bojic, John Niedzwiecki	**[58] Age Specific Patterns in Window Mortality in Avian Populations** • Emma Rhodes, et al.
12:00 PM	**[9] SERNEC: Current efforts in a large-scale collaborative biodiversity project** • Zack Murrell, et al.	**[19] A reflection of the efforts to transform the culture of learning into a more student-centered, student-engaging focus: I had a vision, I made changes, I assessed the outcomes, and now I am adapting accordingly** • Valarie Burnett	**[29] Evaluation of Antibacterial Activity of Microbial Isolates from Soil** • Hakan Sahinoglu, et al.	**[39] Convergent evolution of fluid uptake mechanisms in insects when feeding from porous substrates** • Kristen Reiter, et al.	**[49] Status of Federally Listed Mussels in the Upper Pea River Watershed** • Jonathan Miller, Paul M. Stewart	**[59] Habitat management affects spatial and temporal patterns of genetic diversity** • Richard W. Orton, et al.
12:15 PM	**[10] National Science Foundation Funding Opportunities for Improved Collections Security and Digitization** • Roland Roberts					
12:30 PM 2:00 PM	**Lunch**					

Thursday PM, March 30th

Time	Teaching and Learning Montgomery 7	Zebrafish Symposium Montgomery 1	Ecology: Ecosystem Alabama B	Entomology / Invertebrates / Parasitology Alabama C	Ecology Aquatic Alabama D	Ecology: Conservation Alabama E
2:00 PM	**[60] What Contributes to a Successful Program to Recruit and Engage Math and Science Teachers?** • Cynthia Aulbach, et al.	**[64] Transcriptional regulation of the *Meis2* locus** • Megan Tennant, et al.	**[71] Elemental stoichometry and response to land use of a widespread riverine macrophyte, *Podostemum ceratophyllum* Michx.** • James Wood, et al.	**[76] Fitness consequences of *Wolbachia* infection and sexual mode in a model egg parasitoid** • James Russell et al.	**[81] Development of a Hypothesis to Explain Geographic Differences in the Morphology of *Bellamya japonica* (von Martens 1861)** • Harold Taylor et al.	**[86] Mass Dependent Metabolism in *Bellamya japonica* (von Martens 1861)** • Michael Elbrecht et al.
2:15 PM	**[61] Using reflective writing as a tool for improving understanding** • Jeffrey Thomas	**[65] Modeling gut function with larval zebrafish and transgenic shrimp** • Mary Kinkel	**[72] The effects of differing soundscape on avian vocalization and behavior** • Alexander Schindler, John Quinn	**[77] Dynamics of a venomous spider introduction to the southeastern United States** • J. Scott Harrison	**[82] Assessment of Food Availability of the Larval Eastern Hellbender Salamander (*Cryptobranchus alleganiensis*) in NC and GA Streams** • Sierra Kincaid, Shem Unger	**[87] Resampling to assess variability of the Georgia Index of Biotic Integrity** • William Ensign
2:30 PM	**[62] Can You Use Help in Your Biology Laboratories? Teach Your Undergraduates to be a TA.** • Irma Santoro	**[66] The enteroendocrine morphology of the developing zebrafish intestine** • Kitt Franse, Mary Kinkel	**[73] Testing Holling's Textural-Discontinuity Hypothesis Along an Urban Gradient** • Sara Gagné, et al.	**[78] Spatial Patterns in Morphology of the Invasive Kudzu Bug, *Megacopta cribraria*** • Riley Lovejoy, Jeffrey Lozier	**[83] The effect of freshwater input and seagrass on sediment characteristics in St. Joseph and Apalachicola Bay, Florida** • Erica Strope, Troy Mutchler	**[88] Mobile Bay Living Shoreline Suitability Model** • Chris Boyd, Stephen Jones
2:45 PM	**[63] International Service Learning for Biology and Health Science Majors** • Pearl Fernandes	**[67] The Role of Topoisomerase 2B in neural development in *Danio rerio*** • Mary Skrabut, Bonny Millimaki	**[74] Soil Respiration Change across Forest Harvest Openings** • Deborah Vlach, et al.	**[79] Metal deposits in the cuticle of cicada ovipositors** • Matthew Lehnert, et al.	**[84] Investigating the Role of Long Distance Dispersal in the Response of Stream Fishes to Urbanization** • Andrea Davis, William Ensign	**[89] The impact of human traffic on wildlife abundance on a recreational trail system in Southeastern TN** • Katherine Hesler, Aaron Corbit
3:00 PM		**[68] Developing Zebrafish Artificial Stream Microcosms to understand natural water resources** • Matthew Beblowski, Vinoth Sittaramane	**[75] Understanding the Past, Present, and Future of Land Conservation in South Carolina** • Nicole Berson, et al.	**80] Antimicrobial properties in butterfly saliva** • Valerie Kramer, et al.	**85] Developmental and interactive effects of arsenic and chromium to developing *Ambystoma maculatum* embryos: Toxicity, teratogennicity, and whole-body concentrations** • Steven Gardner et al.	

Time	Teaching and Learning Montgomery 7	Zebrafish Symposium Montgomery 1	Ecology: Ecosystem Alabama B	Entomology / Invertebrates / Parasitology Alabama C	Ecology Aquatic Alabama D	Ecology: Conservation Alabama E
3:15 PM		**[69] Understanding Tumor Microenvironment Using Humanized Zebrafish Tumor Xenograft Model** • Reid Loveless et al.				
3:30 PM		**[70] Creating an Autistic Model in Zebra Fish Utilizing CRISPR/Cas9 Genome Editing** • Paul Lascuna, Vinoth Sittaramane				
3:15 PM–4:45 PM	**BREAK for Posters, Exhibitors, and Coffee** **ASB Poster Session 2 (P002–P116, even numbered posters presented) and ALL PULSE posters (301—329) • Exhibit Hall B**					

Friday AM, March 31st

Time	Cell and Molecular Montgomery 1	Plant Biology/Ecology Alabama C	Populations and Communities Alabama D	Evolution and Genetics Montgomery 7	New Research Across Space and Time Alabama E
8:15 AM	**[90] Differential Venom Gland Gene Expression Between *Centruroides vittatus* Size Classes** • Rafael Pereze, et al.	**[98] Filling the need for flexible, practical, right-sized, updatable floras for field use and publication in the Southeastern United States** • Alan Weakley, Michael Lee	**[108] Rarity, Richness, and Randomness: Assessing the Relationship Between Biodiversity and Rarity at Environmentally-Bound Sites** • Annalee Tutterow, Kevin Smith	**[118] Developing Genetic Markers in Vetiver (*Chrysopogon zizanioides*)** • Christine Bowen, Matt Estep	**[127] The long-term impacts of fire on material inputs and primary producer responses in Long Pond, FL, USA: Evidence from the sediment record.** • Matthew Waters, et al.
8:30 AM	**[91] Highly Invasive Breast Cancer Cell Lines Show a Greater Sensitivity to MAPK Inhibitors by Decreasing Proliferation and Invasion** • Mehdi Chaib, Beth Conway	**[99] How many species of native vascular plants are there in the Southeastern United States?** • Alan Weakley, Derick Poindexter	**[109] Host Selection in the Rare Southeastern Parasitic Plant, *Cuscuta harperi*** • Brandy Rogers, Joel McNeal	**[119] Genetic Diversity and Population Structure in the Clonal *Trillium recurvatum*** • Catherine Major, Jennifer Mandel	**[128] Spatio-temporal variations in climate-growth relationships of longleaf pines (*Pinus palustris*) in Ocala National Forest, Florida** • Diane M. Styers, et al.
8:45 AM	**[92] Implementing a DNA barcoding pipeline to prevent the introduction of invasive species into the Port of Savannah** • Lauren Whitehurst, et al.	**[100] Best practices in lumping and splitting** • Alan Weakley, Derick Poindexter	**[110] Comparative Evaluation Of Wildlife Habitat In A 25-Year-Old Restored Bottomland Hardwood Forest In Response To Three Silvicultural Treatments** • Marshall	**[120] The diversity of populations and genetic structure of the rare endemic *Geum radiatum*** • Nikolai M. Hay, et al.	**[129] Classification of dry coniferous forests and woodlands of the southern Appalachian Mountains** • Thomas Wentworth, et al.

Time	**Cell and Molecular** Montgomery 1	**Plant Biology/Ecology** Alabama C	**Populations and Communities** Alabama D	**Evolution and Genetics** Montgomery 7	**New Research Across Space and Time** Alabama E
			Hart, Joydeep Bhattachjee		
9:00 AM	**[93] Modeling the Mixed-lineage leukemia (MLL1) multi-protein complex in *Saccharomyces cerevisiae*** • Marian Baker, Renée J. Chosed	**[101] Floristic and Ecological Inventory of Native Grasslands of the Springfield Plateau, Northwest Arkansas: A Baseline for Restoration** • Theo Witsell	**[111] Differences in Seed Dispersal Metrics Between Rare and Common Trilliums is Related to Disperser Preference for Common Species** • Chelsea Miller , Charles Kwit	**[121] An exploratory study comparing the bacterial community in the guts of wild and lab-raised *Anopheles quadrimaculatus*** • Eleanor Moen, Jonas King	**[130] Changes in tree species distributions in Great Smoky Mountains National Park reveal legacies of disturbance** • Julie Tuttle, Peter White
9:15 AM	**[94] Effect of Metal Salts on the Pore Size of Diatoms for Various Applications** • D. Vital, et al.	**[102] The Distribution, Reproductive Viability and Nutrient Status of an Endemic Population of Large-Flowered Skullcap Mint (*Scutellaria montana L.*) in Marshall Forest, Rome GA.** • Susan Monteleone	**[112] Genotype, Vegetation structure, and Interspecific Interactions Predict Distribution and Abundance of *Solidago* Specialist Aphids in the Genus *Uroleucon*** • Austin Thomas, et al.	**[122] Small RNA sequencing identifies miRNA roles in ovule and fiber development** • Fulaing Xie, Baohong Zhang	**[131] Directional pollen and seed dispersal in a warming Southeast** • Charles Kwit
9:30 AM –11:00 AM	**BREAK for Posters, Exhibitors, and Coffee** **ASB Poster Session 1 (P001–P115, odd numbered posters presented) • Exhibit Hall B**				
11:00 AM	**[95] The Wnt-signaling gene off-track 2 is required for normal sensory neuron function in *Drosophila* larvae** • Paul Freeman, Andrew Bellemer	**[103] Vascular flora and plant communities of riverscour habitats in Little River Canyon National Preserve, Cherokee and DeKalb Counties, Alabama.** • Zach Irick, Dwayne Estes,	**[113] The Presence of a Non-native Alters Pollinator Activity of a Native Plant Species on Nantucket Island, Massachusetts** • Adam Ramsey, et al.	**[123] Dynamics of Retrotransposons in Grass Evolution** • Andrew Murray, et al.	**[132] Herpetofauna Occupancy of Tidal Swamps** • Sidney Godfrey, Jamie Duberstein

Friday AM, March 31st

Time	**Cell and Molecular** Montgomery 1	**Plant Biology/Ecology** Alabama C	**Populations and Communities** Alabama D	**Evolution and Genetics** Montgomery 7	**New Research Across Space and Time** Alabama E
11:15 AM	**[96] Banding Patterns in Human Hair** • Glenn Cohen, Abena Adaboh	**[104] Mechanisms driving the asymmetrical distribution of *Polystichum acrostichoides* (Christmas fern) on north/south ridges in a southern Appalachian woodland** • David Nielsen, et al.	**[114] Resource allocation drives variable mechanisms of survival after sand deposition** • Joseph Brown, Julie Zinnert, Donald Young	**[124] Patterns of selection acting on transcribed and anonymous microsatellites in latitudinal populations of common sunflower (*Helianthus annuus* L.)** • Chathurani Ranathunge, et al.	**[133] The potential for physiological and behavioral responses to minimize the risk of extinction under climate change** • Eric Riddell, et al.
11:30 AM	**[97] Effects of stress on astrocytes and hormonal protection** • Bridget Smith, Kathleen Hughes	**[105] Phylogenetic and Geographic Distribution of Nickel Hyperaccumulation in Neotropical *Psychotria* (Rubiaceae)** • Grace McCartha, et al.	**[115] Population Distribution of Three Common Caribbean Sea Urchin Species in Belize** • Richard Settele, et al.	**[125] Ecological and evolutionary influences on body size and shape in the Galápagos marine iguana (*Amblyrhynchus cristatus*)** • Ylenia Chiari, et al	**[134] Relationships between land cover/land use, nutrient concentrations, and turbidity of headwater streams in the South Carolina Piedmont** • Greg Lewis, et al.
11:45 AM		**[106] Examining the Clonal Development of Yellow Toadflax *Linaria vulgaris* in Response to 2,4-D Exposure** • Alexander Allmon, Hussein Mohamed	**[116] Creating a microcosm to examine salinity tolerance of *Escherichia coli* in beach sand** • Leigha Stahl, et al.	**[126] Determining the Role of Ecology in the Diversification of Peninsular North American *Paronychia* (Caryophyllaceae)** • John Schenk, et al.	**[135] Nutrients modify the effects of predation in simple aquatic communities** • Clifton Ruehl, Aaron Thomas
12:00 PM		**[107] Chloroplast DNA phylogenetics of the North American *Castanea*** • Matthew Perkins, et al.	**[117] Macrolichens of Kentucky's Land of 10,000 Outcrops on Cumberland Mountain in Harlan County, Kentucky** • Allen Risk		**[136] Large effects of consumer offense on ecosystem structure and function: Implications for water resource management** • Alan Wilson, et al.
12:15 PM –2:00 PM	**Lunch**				

Friday PM, March 31st

Time	Cell and Molecular Montgomery 1	Plant Biology/Ecology Alabama C	Ecology: Pops and Communities Alabama D	Herpetology Montgomery 7	New Research Across Space and Time Alabama B
2:00 PM	**[137] Adipose-Derived Mesenchymal Stem Cells and Porcine Acellular Muscle Matrix Scaffolds for Skeletal Muscle Tissue Engineering and Regenerative Medicine** • Carolina Pham, et al.	**[141] A morphological analysis of *Rhododendron minus* (Ericaceae) in the Carolinas** • Charles Horn			**[156] Succession in metacommunities: diversity-age relationships across trophic levels in pond ecosystems** • Jennifer Howeth
2:15 PM	**[138] Examining the effect of convallatoxin, a cardiac glycoside, on the growth of colorectal cancer cells** • Sarah Anderson, Chris Barton	**[142] Hallmark Features of Stem Anatomy in the Family Lamiaceae** • Catherine Garner, et al.	**[147] Results of a multi-year benthic meiofauna community survey of the northern Gulf of Mexico** • Jamil Ghazal, et al.	**[151] Ecological Limits to Local Species Richness in Dusky Salamanders (genus Desmognathus)** • Carlos Camp, et al.	**[157] Patterns of disassembly as coastal bottomland forest collapses with relative sea level rise** • Loretta Battaglia, Julie Denslow
2:30 PM	**[139] Investigating the anti-proliferative effects of the sesquiterpene Beta-Caryophyllene on HCT116 cells** • Diana Neculcea, Chris Barton	**[143] The origin and evolution of *Buchnera* L. (Orobanchaceae) in the Americas** • Soheila Bayat, et al.	**[148] A Reconnaissance of Mammalian Species Found in Oak Mountain State Park in Shelby County, Alabama** • Lauren Muncher, David Frings	**[152] Burrow Location, Daily Activity, and Temperature Patterns of the Gopher Tortoises, *Gopherus polyphemus*, on Cumberland Island, Georgia** • Alexandria Gagne, et al.	**[158] Ecosystem state change in a coastal system: mechanisms and consequences** • Julie Zinnert
2:45 PM	**[140] Insight Into the Chemotaxis of *Caenorhabditis elegans* Toward Pathogenic *Bacillus Thuringiensis* Strain 4A4 Using Chemosensory Deficient Nematodes** • Stacey Crockett, Robert Grammer	**[144] Reintroducing the Green Violet** • Harvey Ballard	**[149] Seed germination and seedling survivorship of *Gentiana flavida* (Gentianaceae), an endangered species of Kentucky meadows and open woodlands.** • Christopher Adams, et al.	**[153] What's In A Name? Geographic Variability In Folk Knowledge Shapes Human Interactions With Eastern Hellbenders** • Walter Smith, Ashlee Taylor	**[159] Big picture conservation: Linking biodiversity, culture and conservation in the Mobile River basin** • William Finch, John Adornato
3:00 PM		**[145] Phytoextraction of Lead from Firing Range Soil by Kudzu** • Megan Preston, et al.	**[150] Blackwater Ecological Preserve: Longleaf Pine Inventory** • Isaiah Amos, et al.	**[154] Substrate selection of the bonaire whiptail lizard (*Cnemidophorus murinus*)** • Julia Vineyard, Dave Unger	**[160] Panel Discussion**

Time	Cell and Molecular Montgomery 1	Plant Biology/Ecology Alabama C	Ecology: Pops and Communities Alabama D	Herpetology Montgomery 7	New Research Across Space and Time Alabama B
3:15 PM		**[146] Sorting out history and recognizing the true *Habranthus concolor* (Amaryllidaceae)** • Raymond O. Flagg, Gerald L. Smith		**[155] Towards rectifying limitations on species delineation in dusky salamanders (*Desmognathus*: Plethodontidae): An ecoregion-drainage sampling grid reveals additional cryptic lineages** • David Beamer	**[161] Panel Discussion**
3:15 PM – 4:45 PM	**BREAK for Posters, Exhibitors, and Coffee** **ASB Poster Session 3 (P118–P248, even numbered posters presented) • Exhibit Hall B**				

βββ Oral Presentations

Friday PM, March 31st

Time	District I- Riverview 5	District II - Riverview 7
1:00 PM	**VOC interference limits host detection of the parasitic plant *Cuscuta gronovii*** • Audrey Hoffman, Tau Eta, Catawba College	**A survey of freshwater snails and their parasites in Wheeler National Wildlife Park, Alabama** • Tara Burke, Lori Tolley-Jordan, Jessica Wooten, Mu Phi, Jacksonville State University
1:15 PM	**A molecular and microscopic investigation of arbuscular mycorrhizae in quillworts (Isoetes: Isoetaceae)** • Viridiana Mandujano, Karina Noyola-Alonso, F. Jay Bolin, Tau Eta, Catawba College	**Life History Variation of Sooty Elimia between an Open and Closed Canopy Reach** • Jacob Dawson, Terry Richardson, Beta Zeta, University of North Alabama
1:30 PM	**The effect of Zinc (Zn2+) on Uterine Smooth Muscle Cell (UTSMC) proliferation** • Yuting Bai, Sigma Lambda, Wesleyan College	**Comparing the habitat use of parasitized and non-parasitized Elimia godwini (Gastropoda: Pleuroceridae) in a spring-fed stream, Alabama** • Anna Bowden, Lori Tolley-Jordan, Mu Phi, Jacksonville State University
1:45 PM	**Analysis of FOXA1 and ERα Expression in Cervical Cancer** • Amanda Perez, Wanda Schroeder,Sigma Lambda, Wesleyan College	**Antibiotic Resistance: Plamid Transfer Among Bacterial Species** • Breanna Littrell, Beta Zeta, University of North Alabama
2:00 PM	**Wild Brew: Isolation and Genetic Identification of Wild Yeast Strains from Rowan County, North Carolina** • Enrique Garcia, Taylor Parker, Lee Brackman, Andy Maben, Carmony Hartwig, Tau Eta, Catawba College	**Expansion on the Nematode Scent Detection Test: Evaluating *C. elegans* Attraction to Non-Small Cell Lung Cancer** • Brian Song, Robert Grammer, Mu Theta, Belmont University

Time	District I- Riverview 5	District II - Riverview 7
2:15 PM	**Citrus Extracts as Natural Larvicides Against *Culex* Mosquitoes** • Taylor Parker, Carmony Hartwig, Richard Macri, Jay Bolin, Tau Eta, Catawba College	**Examining potential environmental and genetic factors associated with chronic kidney disease of unknown etiology in rural farmers of Sri Lanka** • Patel Harsh, Elisha Okyere, Joseph Mester, Kristi Haik, David Thompson, Mu Iota, Northern Kentucky University
2:30 PM	**Shoulder That Load and Walk: Investigating Foraging Dynamics in Neotropical Leafcutter Ants** • Daniel Brown, Kaitlin Pepper, Kaitlin Ramspeck, and Mark Davis, Psi Rho, University of North Georgia	**The Function of Topoisomerase 2 Beta in Early Neurological Development of Danio rerio** • Aaron Anderson, Bonny Millimaki, Kappa Delta Alpha, Lipscomb University
2:45 PM	**Genetic Response of Shigella flexneri 2a Strain ATCC 29903 Grown in LB broth at different pH** • Kelly Delgado, Stephanie Unkles, Alan Valdiviezo, Kingsley Dunkley, Tau Delta Kappa, Abraham Baldwin Agric. College	**Structural Features of Human Hair** • Abena Adaboh, Trevan Anderson, Brandon Rivers, Mu Epsilon, Troy University
3:00 PM	**Foraging choices of American Beaver: Effect of tree species, diameter, and distance from water** • Joel D. Schlaudt, Katherine J. Shumaker, Audrey C. Hoffman, Joseph P. Poston, Tau Eta, Catawba College	**Anti-proliferative effects of epigallocatechin-gallate and enoxacin on cervical cancer-derived cells in culture** • Anna Margaret McDonnell, Christopher Barton, Mu Theta, Belmont University
3:15 PM	**Expression of the Polyhydroxybutyrate Depolymerase Gene of Streptomyces sp. 5A in Streptomyces lividans TK24** • Charles E. Booth, Nu Upsilon, Bridgewater College	**The seasonal prevalence of female sex cells in gonads of male largemouth bass (Micropterus salmoides) from the Chattahoochee River system** • Amy Adams, Mu Omicron, Columbus State University
3:30 PM	**Phytoextraction of Lead from Firing Range Soil by Kudzu** • Megan Preston, Kenneth Slaton, Gina Kurtulis-Tartar, Beta Chi Nu, Dalton State College	**A comparison of age and the prevalence of intersex within Largemouth Bass (Micropterus salmoides) in the Columbus, Georgia area of the Chattahoochee River** • Jeramy Belt, Mu Omicron, Columbus State Univ.
3:45 PM	**Factors affecting anuran presence in Brevard County, Florida** • Sebastian Martinez, Sigma Psi, Florida Institute of Technology	**Altruism in Colonies of the Yeast Saccharomyces cerevisiae and the Effects of Nutritional Parameters on Colony Growth and Cell Viability** • Michael Rohly, Mu Omicron, Columbus State University
4:00 PM	**Effects of light and temperature on the toxicity of Florida Red Tide** • Erika Neave, Sigma Psi, Florida Institute of Technology	**The Effects of Fertilizer on Decomposition of Native and Invasive Exotic Plant Species in a Temperate Deciduous Forest** • Gary Noel, Darlene Panvini, Mu Theta, Belmont University
4:15 PM	**Inorganic Pyrophosphatase modulates paralysis in an Alzheimer's disease model** • Jasmin Pimentel, Sigma Psi, Florida Institute of Technology	**Characterization of the substrate specificity of Citrus paradisi glucosyltransferase mutant D344P** • Nathan Spaulding, Pi Delta, East Tennessee State University

Posters

Hall B THURSDAY, March 30th • Posters P001–P116*
Presenters of Odd # Posters need to be present 9:30–11:00 AM • Presenters of Even # Posters need to be present 3:15–4:45 PM
***All PULSE posters (P301-P329) presented in PM Session**

Thursday, March 30th • ASB Posters P001–P116

ANIMAL BIOLOGY

P001 **Seasonal Changes in Maturation of Adult *Cotylaspis insignis* (Trematoda: Aspidogastridae) Recovered from the Fat Mucket, *Lampsilis radiata luteola* (Bivalvia: Unionidae).** • Hsuan Peng et al.

P002 **Variation in nickel concentrations among populations of the high-Ni insect *Melanotrichus boydi* (Hemiptera: Miridae)** • Jiyeong Choi et al.

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P223 **The Effects of E-cigarette Exposure on Cell Viability and Gene Expression** • C.M. Hale et al.

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P224 **Analysis of local population of *Wolbachia* strains** • Emily Flingos et al.

P225 **A Study of E. coli in Lake Martin, Alabama** • Artchandra Marks, Brian Burnes

P226 **The use of bacteriophage in preventing bacterial infection of *Caenorhabditis elegans* by *Bacillus thuringiensis kurstaki*** • Katherine Cochran et al.

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P232 **Contribution of decomposer fungi to the litter decomposition of two grass species, *Schizachyrium scoparium* and *Schizachyrium tenerum*.** • Matthew Lodato et al.

P233 **Antimicrobial properties and preliminary microbial ecology of leaf beetle fecal cases** • Diana Wong et al.

P234 **Macrolichen Inventory of the Eagle Lake Watershed** • Kendall McDonald, Allen Risk

TEACHING AND LEARNING

P235 **The making of a university insect collection** • Lauren Sanker et al.

P236 **Utilizing Pulmonate snails as subjects in semester-long behavioral experiments to generate testable hypotheses** • Amy Wethington

P237 **Bio-Bridge: A Research and Study Skills Bridge Program for Transfer Students** • Allison Claybrook et al.

P238 **Effects of Sleep Deprivation on Biomarkers of Obesity - Sleep Quality, Perceived Stress, and Depression and Anxiety Scores among College students** • Francisca Freire

P239 **Formal involvement of students in new course development provides a unique educational experience and valuable perspective for both students and the instructor** • Matthew Stern

P240 **Designing An Engaging Lab Manual** • Michelle Tremblay

P241 **Exploration of Human Pancreatic Cancer by Undergraduates as Entry Point into Next-Generation Sequence Analysis** • Tabatha Grainger, Latanya Hammonds-Odie

P242 **Time travel to T.H. Morgan's lab: Teaching transmission genetics by gamification** • Amy Wiles

P243 **Bridging the Genetics Gap: Combining Human Pedigree Analysis with VNTR technology for an Undergraduate Genetics Course Series Activity.** • Ghada Bedwan et al.

P244 **From natural selection to classification: A new engagement curriculum to build on concepts for High School Biology** • Alexander Krings

P245 **Students Take Charge: Teaching Students to Own their Education in the Introductory Biology Classroom** • Virginia Young, Michael Moore

P246 **The Undergraduate Teaching Experience** • Amy Williams, Irma Santoro

P247 **A novel way to create a crime scene for forensic science classes.** • Patricia Redden et al.

P248 **Using Classroom-Based Undergraduate Research to Enhance Student Learning While Examining Global Change** • Jennifer Rhode Ward et al.

PULSE Posters

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P301 **Fostering Faculty Development to Increase Inclusiveness and Student Higher Order Cognitive Skills** • Charles Winder et al.

P302 **SERP III: Strategies to Innovative Teaching and Overcoming Challenges at Alabama State University** • Diann Jordan, Kartz Bibb

P303 **Curriculum reform: Down in the trenches, a bird's eye view** • Zack Murrell, Sarah Marshburn

P304 **Transforming the Biological Sciences Curriculum and Instructional Program at Auburn University** • Jason Bond et al.

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P305	**The Ripples Produced by Early CUREs** • Barbara Musolf et al.
P306	**That's EPIC2 (Engaging Pedagogies in Collaborative Classrooms): Metacognition and More - Adding Collaboration to Improve Science Learning** • Heather Aloor et al.
P307	**Longitudinal Assessment on Implementation of Curricula Changes in Southern Appalachia** • Joseph Bidwell et al.
P308	**Ask Me What I'm Working On: A Liberal Arts STEM Cohort as a Scaffold for Undergraduate Research** • George Argyros et al.
P309	**Small Seeds of Change Can Lead to Faculty Engagement and Diverse Pedagogies.** • Chrisha Dolan
P310	**SOARing Eagles: Student Opportunities for Authentic Research** • Lyndsay Rhodes, Charles Gunnels
P311	**Vision and Change at Georgia Tech: Strengthening the PULSE** • Jung Choi et al.
P312	**New Horizons in Biology at James Madison University** • Tim Bloss et al.
P313	**Realizing Vision and Change: Completion of an Undergraduate Biology Program Redesign** • Lisa McDonald et al.
P314	**Save the Bears: An Update on the Action Plan of Mercer University's Biology Department** • Linda Hensel et al.
P315	**College-wide Implementation of Adaptive Learning Tools in Non-Majors Biology Courses and Impact on Student Achievement** • Alfredo Leon
P316	**A focus on Curricular and Extracurricular Student Engagement and Critical Thinking: Continuing Strategies to Strengthen the P.U.L.S.E. of the Newberry College Biology Program** • Valarie Burnett et al.
P317	**From Classical to Modern Pedagogy: A Case-Study** • Maureen Scott
P318	**Engaging Students Through Sustained Research Experiences** • Dixie Gautreaux et al.
P319	**Aligning the Radford University Biology Program with *Vision and Change*: Action Steps Toward Improving Core Competencies and Metacognitive Skills Through Student-Centered Learning and Authentic Research** • Christine Small et al.
P320	**Experiments in Re-designing Introductory Biology to Align with Vision and Change** • Bobby Fokidis et al.
P321	**A Chance to be Creative: Assessing the Department of Biology at Samford University** • George Keller et al.
P322	**Shaw on a Mission through Vision and Change** • Vonda Reed
P323	**Tackling Curricula Reform using *Vision and Change*: Efforts at a Research-Intensive University** • Kristen Miller et al.
P324	**Transforming Education by Enhancing Student Metacognitive Skills** • Srinivas Garlapati et al.
P325	**Taking the PULSE at UNCW: A plan for curriculum review and change, Department of Biology and Marine Biology** • Christopher Finelli et al.
P326	**Development and Initial Implementation of the Winthrop University SERPII Action Plan** • Matthew Stern et al.
P327	**Transforming the Culture for STEM Teaching and Learning** • Angela White et al.
P328	**Investigating the Impact of Collaborative Make-up Exams** • Wilfred Amoako et al.
P329	**Biologists engaged in Consensual Curricular Revision** • G. R. Davis

βββ Posters

Friday March 31st, 9:30 am–Noon

βββ 1	**Impact of myeloid cell NF-κB signaling on glioblastoma growth** • Natasha Venugopal, Shelby Howard, Bhagelu Achyut, Meenu Jain, Ali Arbab, and Jennifer W. Bradford, Kappa Kappa, Augusta University
βββ 2	**Behavioral and molecular effects of the insecticide carbaryl on the salt-marsh killifish *Fundulus heteroclitus*** • Kendall Maze, Andrew Shirley, and Nancy Eufemia Dalman, Rho Psi chapter, University of North Georgia
βββ 3	**The Influence of Zn+2 on Human Prostate Smooth Muscle Cell's Proliferation** • Yang He,Sigma Lambda, Wesleyan College
βββ 4	**Modeling CD4 Expression with Short Lived EGFP** • Chika Fujii, Tau Omega, Davidson College
βββ 5	**The effects of molecular weight on the antimicrobial and wound healing properties of chitosan in Carassius auratus** • Stephanie Reidell, Psi Chi Chapter, Virginia Wesleyan College
βββ 6	**The release of zooxanthellae in Aiptasia pallida due to environmental stress** • Lisa Nguyen, Deidre Gonsalves-Jackson, Psi Chi, Virginia Wesleyan College
βββ 7	**Clonal Root Development of the Yellow Toad Flax *Linaria vulgaris*** • Leslie Elrod,Beta Chi Nu, Dalton State College
βββ 8	**Comparison of Bt vs Conventional Field Corn in Production Yield** • Kelsey Smith, Christine Fleet, Eta Iota, Emory & Henry College
βββ 9	**Quantifying Sepallata Concentrations in Reproductive Organs of Phalaenopsis** • Lindsey Dean, Christine Fleet, Eta Iota, Emory & Henry College
βββ 10	**Phylogeography of Montane Salamanders in Southwest Virginia: A Mitochondrial Analysis** • Erin Kirk, George Argyros, Eta Iota, Emory & Henry College
βββ 11	**Epithelial Mucosal Swabbing of Frogs (Ranidae) as an Indicator of Bovine Fecal Coliform Contamination of Aquatic Habitats in Southwest Virginia** • Brandon Gearhart, Melissa Taverner, George Argyros, Eta Iota, Emory & Henry College
βββ 12	**Analysis of NOTCH1 Expression in Cervical Carcinoma Cells** • Zahna Bigham, Wanda Schroeder, Sigma Lambda, Wesleyan College
βββ 13	**The Expression of GATA-3 in Cervical Carcinoma** • Monica Mohanty, Wanda Schroeder, Sigma Lambda, Wesleyan College
βββ 14	**Effect of root-knot nematode parasitism on yield and sugar content of sugar beet in Georgia** • Emily R. Boyd, Richard F. Davis, Theodore M. Webster, Brian T. Scully, Timothy B. Brenneman, Tau Delta Kappa, Abraham Baldwin Agricultural College
βββ 15	**A study of an aquatic turtle assemblage in a northwest Georgia lake and wetland prior to restoration** • Jonathan Leberman, Carrie Swinney, Chris Manis, G. John Lugthart, Beta Chi Nu, Dalton State College
βββ 16	**Antimicrobial Properties of Venom from Native Snakes of Southeastern United States** • Annalia Ramos, Cantrell Dillion, Beta Chi Nu, Dalton State College
βββ 17	**Nose Goes: Alzheimer's Olfaction and *C. elegans* Chemotaxis** • Amanda Green, Tanner Watkins, Heather Cathcart, Tau Delta Kappa Chapter, Abraham Baldwin Agricultural College
βββ 18	**Analysis of Pesticide Residues in Georgia's Groundwater** • Jessica Bell, Tau Delta Kappa, Abraham Baldwin Agricultural College

Friday March 31st, 9:30 am–Noon

βββ 19	**Survey of Amphibians in a Northwest Georgia Urban Wetland** • Tegan Hendricks, Harrison Daley, Chris Manis, John Lugthart, Beta Chi Nu, Dalton State College
βββ 20	**Oncolytic Vesicular Stomatitis Virus Alters Cancer Cell Invasion Mechanisms** • Brittany DeVasure, Dakota Goad, Darren Seals, Maryam Ahmed, Beta Psi, Appalachian State University
βββ 21	**A Survey of Amphibians In A Northwest Georgia Urban Wetland** • Daley Harrison, Tegan Hendricks, Beta Chi Nu, Dalton State College
βββ 22	**Worker Subcaste Behavior in Neotropical Leafcutter Ants** • Kaitlin Pepper, Kaitlin Ramspeck, Daniel Brown, and Mark Davis, Psi Rho Chapter, University of North Georgia
βββ 23	**Comparative Study of Mosquito Biodiversity in Rowan and Cabarrus Counties, North Carolina** • Shannon Garrick, Chrystal Swinger, Carmony Hartwig, Bruce Harrison, Joshua York, Elizabeth Brown, Parker Whitt, Ryan Harrison, Hugh Smith, and Marlon Barber, Tau Eta Chapter, Catawba College
βββ 24	**Modeling the MAPK Cascade in Starfish Oocytes** • Abigail Rich, Claudia Kassouf, Semen Koksal, David Carroll, Beta Alpha Chapter of BBB, Salem College
βββ 25	**The role of starvation and cellular differentiation in polyhydroxybutyrate depolymerase synthesis in *Streptomyces* sp. 5A** • Kara Jones, Nu Upsilon, Bridgewater College
βββ 26	**Identification of Mutations in the Polyhydroxybutyrate Depolymerase gene of Bald Mutants of Streptomyces 5A** • Michelle Reed, Nu Upsilon, Bridgewater College
βββ 27	**Adolescent Oxycodone Exposure's Impact on Drug Sensitivity in Adulthood** • Dominique Johnson, Nu Upsilon, Bridgewater College
βββ 28	**Do Antioxidants=Anti-Alzheimer's? Affects of Antioxidants on APL-1 in *C. elegans*** • Tanner Watkins, Amanda Green, Joseph Falcone, Heather Cathcart, Tau Delta Kappa, Abraham Baldwin Agricultural College
βββ 29	**Techniques in characterizing the morphology of osteocyte cell bodies and their dendrites** • Elias Moreno, Leslie Pryor McIntosh, Tau Delta Kappa, Abraham Baldwin Agricultural College
βββ 30	**An Acute study of the Toxic Effects of TiO2 on *Daphnia magna*** • Zach Bowens, Naoma Nelsen, Erskine College
βββ 31	**Detection of Pathogens and Markers of Permethrin Resistance in Human Lice from Madagascar** • Shamta Warang, Titilope Ogunleke, Danielle Capps, Lance A Durden, Sarah Zohdy, and Marina E. Eremeeva, Tau Kappa Chapter, Georgia Southern University and School of Forestry & Wildlife Sciences
βββ 32	**Environmental factors influencing gopher tortoise distribution at Merritt Island National Wildlife Refuge** • Allie Leight, Beta Alpha, Salem College
βββ 33	**Protein concentration variations in larval Gobiidae** • Maddison Harman, Sigma Psi Chapter, Florida Institute of Technology
βββ 34	**Determinants of Reef-Fish Assembly in Pacific and Caribbean Coral Reefs After the Establishment of Marine Protected Areas (MPAs)** • Victor Rodriguez Ruano, Sigma Psi Chapter, Florida Institute of Technology
βββ 35	**Identification of the Heat Shock Protein Family in the Starfish Oocyte and Egg** • Altair Dubé, Sigma Psi Chapter, Florida Institute of Technology
βββ 36	**Forensic Sample Digestion: What Microbes are Eating Human Proteins** • Jason Floyd, Beta Zeta, University of North Alabama
βββ 37	**Effect of Crude Oil on Vibrio parahaemolyticus, a Causative Bacterium of Seafood Poisoning** • Kristina Bokenfohr, Mu Epsilon, Troy University
βββ 38	**Bacterial Communities Residing in Core and Surface of Tar Balls on the Gulf Coast Beaches** • Callie S. Bennett, Mu Epsilon, Troy University
βββ 39	**High-Dose Taurine Causes Cognitive and Behavioral Deficits in Adolescent and Young Adult Mice With Highest Risks in Males** • Yislain Villalona, Mu Iota, Northern Kentucky University

Friday March 31st, 9:30 am–Noon

βββ 40	**The Involvement of Estrogen Receptors in Astrocyte Survival** • Lauren Johnson, Mu Omicron, Columbus State University
βββ 41	**Detection of Neutrophil Apoptosis in Response to *Haemophilus influenzae*** • Rachel Pearson, Mu Omicron, Columbus State University
βββ 42	**Intracellular Survival of *Acinetobacter baumannii* in Human Neutrophils** • Rowan Pitts, Mu Omicron, Columbus State University
βββ 43	**Foxi3 Ablation Retards Bone Derived Prostate Cancer Cell Growth** • William Byrd, Angana Mukherjee, Saeed Ahmed, Shanice Theodore, Jacqueline Jones, Mu Epsilon, Troy University
βββ 44	**Hilpertshauser, Leah The physico-chemical relationship between an open and closed canopy reach of a first-order stream, containing *Elimia paupercula* Beta Zeta University of North Alabama**
βββ 45	Windmiller, Reid A Toxicity Study of Tetracycline and Titanium Dioxide Nanoparticles on the Nematode Caenorhabditis elegans and the Rotifer Philodina acuticornis. Sigma Gamma Erskine College

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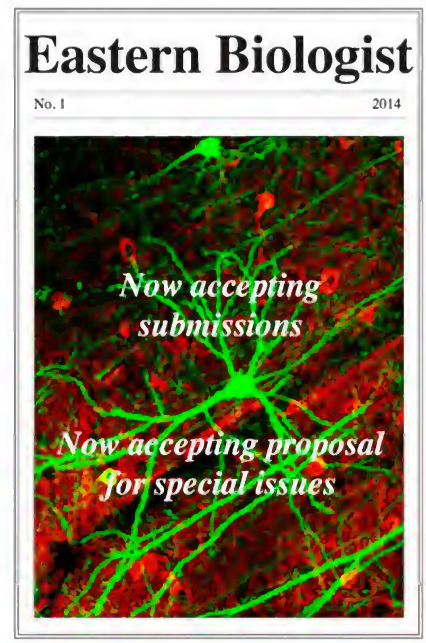

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